

# PARASITES OF SCOMBROID FISHES. PART I. MONOGENETIC TREMATODES, DIGENETIC TREMATODES, AND CESTODES\*

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## INTRODUCTION

Recent works on helminth parasites, notably by Southwell (1925, 1930), Dollfus (1912-1949), Price (1936-1943), Manter (1926-1954), Nagaty (1937), Dawes (1941, 1946), Sproston (1946), Wardle and McLeod (1952), Yamaguti (1934, 1955, 1958, 1959), and several others have helped in establishing a sounder classification of helminth parasites, especially those infesting fishes. Detailed observations on the ecology and biology of helminth parasites infesting fishes lag far behind as compared to medical helminth parasitology, as the stage of discovering and describing new species of helminths, the reporting of new host records and distributional records, life history studies, etc., is not over since many groups of fishes still remain uninvestigated for parasites.

The scombroid fishes, which as a whole constitute a very important or in fact the most important single element in the marine fishery resources of the world has received some attention from workers engaged in the study of fish parasites. It may be safely said that in view of the commercial importance of this group of fishes more and more species may be subjected to the scrutiny of those interested in fish parasites. Only within the last decade has our knowledge about the species of scombroid fishes crystallised into some definiteness and this should greatly aid precise host determination.

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There is not a single endemic species of scombroid fish (mackerels, seerfishes or spanish mackerel, tunas and billfishes) in the Indian seas. Several are very widely distributed in the Indo-Pacific (e.g., *Rastrelliger kanagurta*, *Scomberomorus commerson*, *Thunnus (N.) a. macropterus*, etc.), while a few evince pantropical distribution (e.g., *Katsuwonus pelamis*, *Scomber japonicus*, *Xiphias gladius*, *Istiophorus gladius*, etc.), and as such it was felt that to serve any useful purpose, this coverage of parasites of scombroid fishes should be on a world-wide basis. The lack of any comprehensive work of this nature on this group of fishes, has made the completion of the present task all the more necessary.

Both structural and physiological adaptations are involved on the part of the parasite species which may occupy diverse situations on or within the body of the host species. The common sites to look for them are the peritoneum, muscles, mesentery, mucous membrane of the branchial cavity or the skin of the head or body, or beneath scales where they may be encysted, or found free in the stomach, pyloric caeca, intestine, anal region, base of branchial arches, mouth, on gill lamellae, inside of operculum, submental groove, etc. In the marine environment, especially amongst cestodes where at least two intermediate hosts are present, only late larval stages infest teleostean fishes, cephalopods, etc. while adults are generally found in elasmobranchs. No doubt this state of affairs has given rise to the chaos in species nomenclature in Cestoda, which thanks to some of the works mentioned earlier has been straightened to a certain extent. In the other groups dealt with also, at the species level the nomenclature is in a nebulous state in many instances, as the criteria for distinguishing the different species are not well defined, and variations seen in the same parasite species from host to host (of closely related host species or 'unrelated' host species), and from different geographical areas have tended to complicate matters. One good instance is that given by Wardle and McLeod (1952) also involving scombroid fishes as host species. They remark that 'There occurs, also, in hosts as far separated taxonomically and geographically as *Tetrapturus albidus*, *Histiophorus gladius*, and *Tarpon atlanticus* of the north Atlantic, *Histiophorus* sp. of the Indian and Pacific Ocean, a bothriocephalid cestode characterised by a clubshaped holdfast, a broad, frilled body, and a gravid uterus at least one-third of the segment width. At present this form is separated according to host distribution and certain alleged differences into a number of species—*plicatus* Rudolphi, *manubriiformis* Linton, *occidentalis* Linton, *laciniatus* Linton, *histiophorus* Shipley, and so forth; but it is not improbable that these, again, are merely forms of the originally described *plicatus*'.

The need for examining good series of specimens before describing new species of helminths is well stressed in the following observation by Hargis (1956) based on his experience of species of the monogenetic trematode genus *Lithiodocotyle*. 'In the early part of the study it was suspected by the writer that several species of *Lithiodocotyle* were represented in the collection because those from *S. maculatus* were smaller than those from *S. cavalla*. However, later studies revealed overlaps in many of the countable and measurable characters and such a similarity of organs that it is impossible to consider either of the populations from these two host species as new.' This finding, no doubt, shows also the close affinities between the two host species belonging to the genus *Scomberomorus*. Another point it stresses is the great need to be cautious and as far as possible refrain from describing new species of helminths of the same genus from one or more than one closely related host species based on single specimens!

Considering the number of species of scombroid fishes left uninvestigated for parasite species, and in the absence of proper distributional data on the known species of parasites, it is rather premature to discuss matters pertaining to host specificity, zoogeography of scombroid fishes and their parasites, and so forth. However, investigations on helminth parasites as a whole indicate that the monogenetic trematodes evince host specificity to the greatest degree, while the cestodes show the least, reflecting on the complicated life cycle of the latter. This general trend is evident in helminth parasites of scombroid fishes also. Meserve (1938) described 22 species of monogenetic trematodes from the Galapagos Islands and vicinity, after examining five hundred fish specimens belonging to at least one hundred species, and all 22 parasite species were from single host species respectively showing the high degree of host specificity. Multiple

infestation is rather less frequent in this group, but is more common among digenetic trematodes and cestodes.

For obtaining a proper perspective of host-parasite relationship, especially of scombroid fishes and their parasites, information about the non-scombroid hosts of the parasite species is also necessary. In all instances this may not be complete, but data of this nature while throwing light on the adaptability of the parasite species to infect successfully different hosts of closely related species or species belonging to widely different families in the same habitat or widely different habitats, will also aid in our understanding of the natural spatial distribution of the parasite species.

The appeal made to parasitologists by Baylis (1926) and several others for the correct use of host names is again repeated. One purpose of this work has been to straighten out the nomenclature of the host species. Often names 'non-existent' are used (e.g. *Cybium lanceolatus* the host of *Pricea multae* Chauhan, 1945), and as the systematics of scombroid fishes in days gone by was not sound, mis-identifications of host species do exist. Careful evaluation based on recent researches on the taxonomy of scombroid fishes, the distributional ranges of the different species, etc., has been made in order to give up-to-date names for host species. When doubt exists as in the case of *Cybium lanceolatus*, which could be meant to 'represent' any one of the three species of *Scomberomorus* from Indian seas, the host is given here as *Scomberomorus* sp., and in the host-parasite list the parasite species name is also given with a query under the names of the three Indian species of *Scomberomorus*. It will be desirable to have it so until fresh collections could be made to determine the host species.

In the absence of any recent monographic work covering all species of scombroid fishes (mackerels, seerfishes or spanish mackerels, tunas, and billfishes), which would have aided in the identification of host species, the next best that could be thought of is to give a list of important references pertaining to the systematics of scombroid fishes published in recent years from various parts of the world. This list is appended at the end after a list of references to scombroid fish parasites. Where it has not been possible to check up original host names of scombroid fishes as given when a parasite was first described, I have used the name as given by Yamaguti (1958 and 1959) for digenetic trematodes and cestodes and also indicated the up-to-date names along side. I shall welcome suggestions and shall be most thankful to readers for drawing my attention to any omissions.

## MONOGENETIC TREMATODES

### ORDER : MONOGENEA

#### Suborder : MONOPISTHOCOTYLEA

#### Superfamily : GYRODACTYLOIDEA

#### Family : DACTYLOGYRIDAE

#### Subfamily : DACTYLOGYRINAE

#### Genus DACTYLOGYRUS Diesing, 1850

#### *Dactylogyrus inversus* Goto and Kikuchi, 1917

*Scombroid host* : *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn]

*Locality* : Japan.

*Non-scombroid host* : *Lateolabrax japonicus* [Japan].

*Location* : Gills.

*Reference* : Ishii and Sawada (1938).

## Superfamily : CAPSALOIDEA

## Family : CAPSALIDAE

## Subfamily : CAPSALINAE

Genus *Capsala* Bosc, 1811, emend. Price, 1939

(Syn. *Phylline* Oken, 1815 in part; *Tristoma* Cuvier, 1817 in part; *Tricotyle* Guiart, 1938; *Tristomella* Guiart, 1938; *Capsala* Guiart, 1938 in part)

Recent reviews on the genus *Capsala* by Price (1938) and Sproston (1946), and later records of new species referable to this genus indicate that less than thirty valid species are known. Out of these, I have been able to find references to at least eighteen species which occur on scombroid fishes (see also addendum).

***Capsala biparasitica* (Goto, 1894)**

(Syn. *Tristomum biparasiticum* Goto, 1894)

*Scombroid host* : *Thynnus albacora* [= *Thunnus* (*Neothunnus*) *albacares macropterus* (Temminck and Schlegel)]

*Locality* : Misaki, Japan, Pacific.

*Non-scombroid hosts* : None.

*Location* : On carapace of copepod *Parapetalus* sp. on gills of tuna.

*Remarks* : See also Dollfus (1922, p. 292).

***Capsala caballerio* Winter, 1955**

*Scombroid host* : *Sarda orientalis* (Temminck and Schlegel)

*Locality* : Pacific coast of Mexico.

*Non-scombroid hosts* : None.

*Location* : Gills.

***Capsala gouri* Chauhan, 1951**

*Scombroid host* : *Thynnus thunnina*\* [= *Euthynnus affinis affinis* (Cantor)]

[\*not *T. thumina* as given in *Zool. Rec.* 1954, p. 91 (1957).]

*Locality* : Bombay, India (Arabian Sea).

*Non-scombroid hosts* : None.

*Location* : Operculum of host.

***Capsala katsuwoni* (Ishii, 1936), Sproston, 1946**

(Syn. *Tristoma katsuwonum* Ishii, 1936)

*Scombroid host* : *Katsuwonus vagans* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Japan, Pacific.

*Non-scombroid hosts* : None.

*Location* : Gills.

**Capsala laevis** (Verrill, 1874), Johnstone, 1929, Price, 1939

(Syn. *Tristoma laeve*, Verrill, 1874; *Tristomum histiophori* Bell, 1891; *Tristoma laeve* var. *armata* Goto, 1899)

**Scombroid hosts :** 1. *Histiophorus* (sic) *brevirostris* (Day) [= *Makaira indica* (Cuvier)]  
 2. *Gymnosarda pelamys* [= *Katsuwonus pelamis* (Linnaeus)]  
 3. *Tetrapturus lessonae* [= *Tetrapturus belone* Rafinesque]  
 4. *Tetrapturus albidus*  
 5. *Xiphias gladius*

**Localities :** (1) Madras, E. coast of India, Bay of Bengal; (2) South of Martha's Vineyard, N.W. Atlantic; (3) N.W. France; (4) Block Is.; (5) Atlantic.

**Non-scombroid hosts :** *Coryphaena hippurus* (from Atlantic).

**Remarks :** See for discussions on nomenclature, Johnston (1929), Price (1939) and Sproston (1946).

**Capsala manteri** Price, 1952

**Scombroid host :** *Euthynnus alletteratus* (Rafinesque)

**Locality :** Tortugas, Florida, U.S.A. (Atlantic).

**Non-scombroid hosts :** None.

**Location :** Gills.

**Capsala megacotyle** (von Linstow, 1906), Johnston, 1929, emend. Price, 1939

(Syn. *Tristoma megacotyle* von Linstow, 1906; *Capsala megacephala* Johnston (*megacephala* for *megacotyle*—an error); *Tristomella megacotyle* Guiart, 1938)

**Scombroid host :** 'Sword fish, *Histiophorus* sp.' [= ? *Istiophorus gladius* (Broussonnet) or *Makaira* sp.]

**Locality :** Beruwala, W. coast of Ceylon.

**Non-scombroid hosts :** None.

**Location :** On surface of body.

**Remarks :** Accurate host identification is not possible for the following reasons: The popular name 'swordfish' is not used for *Histiophorus* (= *Istiophorus*) which is well known as the 'sailfish'. The swordfish, *Xiphias gladius* is extremely rare in these waters, but on the contrary, species of marlins or spearfishes (*Makaira* and *Tetrapturus*) are not uncommon along the Ceylon coast and in the past have often been mistakenly identified as swordfish. As the host of *C. megacotyle* could thus as well be a marlin, this is indicated. The matter may be settled by making fresh collections.

**Capsala nozawae** (Goto, 1894)

Syn. *Tristomum nozawae* Goto, 1894; ? *Capsala* (*Tristomum*) ? *nozawae*, Baylis, 1939

**Scombroid host :** 1. *Thynnus sibi* [= ? *Thunnus* (T.) *alalunga* (Bonnaterre), or ? *Thunnus* (*Parathunnus*) *obseus mebachii* Kishinouye]

2. *Thunnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]

3. *Katsuwonus vagans* [= *Katsuwonus pelamis*]

**Localities :** 1. Japan, Pacific; 2. North Sea; 3. Japan.

**Non-scombroid hosts :** None.

**Location :** On fins.

**Remarks :** The specific name *sibi* of the host species has been used to denote more than one species of tuna. Boeseman (1947) considered it to be synonymous with *Thunnus alalunga*. However, Rivas (1961) feels that *T. sibi* is a valid species of which *Parathunnus mabachi* Kishinouye is a synonym and *Parathunnus* Kishinouye a subgenus of *Thunnus*. In keeping with Boeseman's findings and a recent review of Indian tunas (Jones and Silas, 1960), two host names are given with query as likely hosts of *C. nozawae* from Japanese waters. Baylis's record as mentioned by him is doubtful.

***Capsala ovalis* (Goto, 1894), Price, 1938, emend. Sproston, 1946**

(Syn. *Tristomum ovale* Goto, 1894 ; *Tristoma ovale* Goto, 1899 ; *Capsala ovale* Price, 1938)

**Scombroïd hosts :** 1. *Histiophorus orientalis* [= *Istiophorus gladius* (Broussonnet)]  
2. *Cybiu niphonium* [= *Scomberomorus niphonius* (Cuvier and Valenciennes)]  
3. *Histiophorus* sp. [= *Istiophorus gladius* (Broussonnet) or ? *Makaira* sp.]

**Localities :** 1 & 2. Japan, Pacific ; 3. Ceylon.

**Non-scombroïd hosts :** None.

**Location :** On surface of body.

**Remarks :** Earlier comments about identity of host species from Ceylon given under *Capsala megacotyle* are also applicable here. For discussion on the nomenclature of the parasite species, reference is invited to Price (1938), Sproston (1946), and Chauhan (1951).

***Capsala pelamydis* (Taschenberg, 1878)**

(Syn. *Tristoma pelamydis* Taschenberg, 1878)

**Scombroïd host :** *Pelamys sarda* [= *Sarda sarda* (Bloch)]

**Locality :** Naples, Mediterranean.

**Non-scombroïd hosts :** None.

**Location :** ?

***Capsala thynni* (Guiart, 1938)**

(Syn. *Tricotyla thynni* Guiart, 1938)

**Scombroïd host :** 1. *Thynnus albacora* [= *Thunnus* (*Neothunnus*) *albacares albacares* (Bonaterre)]  
2. *Germo alalunga* [= *Thunnus* (*T.*) *alalunga*]

**Locality :** 1. Off mouth of River Loire, open Atlantic, off France. 2. Atlantic.

**Non-scombroïd hosts :** None.

**Location :** Gills.

**Remarks :** Sproston (1946, p. 525) refers to *Germo alalunga* as the host of *C. thynni*. *Thunnus albacares* is the Atlantic yellowfin, and that from the Indo-Pacific has generally been considered to be distinct and denoted as '*Neothunnus macropterus*'. Provisionally *Neothunnus* is considered subgenerically distinct from *Thunnus* s.str., (Rivas, 1961), and in this work, the Atlantic yellowfin and Indo-Pacific yellowfin tunas will be denoted as *T. (N.) albacares albacares* and *T. (N.) albacares macropterus*, respectively.

**Capsala poeyi** (Vigueras, 1935), Price, 1938(Syn. *Tristoma poeyi* Vigueras, 1935)*Scombroid host* : *Makaira ampla* (Poey) [= *Tetrapturus ampla* Poey]*Locality* : Cuba.*Non-scombroid hosts* : None.*Location* : Gills.**Capsala magronum** (Ishii, 1936) emend. Price, 1938(Syn. *Tristoma magronum*—also *T. magnronum* (misprint) Ishii, 1936)*Scombroid host* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]*Locality* : Japan, Pacific.*Non-scombroid hosts* : None.*Location* : On body?**Capsala onchidiocotyle** (Setti, 1899)(Syn. *Tristoma onchidiocotyle* Setti, 1899)*Scombroid host* : 1. *Thynnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]2. *Parathunnus obesus* [= *Thunnus* (P.) *o. obesus*]*Locality* : 1. Elba, Portoferraio, Mediterranean. 2. Coast of Angola, Atlantic.*Non-scombroid hosts* : None.*Location* : ?**Capsala maccallumi** Price, 1939*Scombroid host* : *Euthynnus alletteratus* (Rafinesque)*Locality* : Woods Hole, Massachusetts, U.S.A.*Non-scombroid hosts* : None.*Location* : Gills.**Capsala interrupta** (Monticelli, 1891), Price, 1938(Syn. *Tristoma interrupta* Monticelli, 1891)*Scombroid hosts* : *Thynnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]*Katsuwonus pelamis* (Linnaeus)*Locality* : Mediterranean.*Non-scombroid hosts* : None.*Location* : Gills.*Remarks* : See Sproston (1946).

**Capsala lintoni** Price, 1939(Syn. *Tristoma laeve* Verrill of Linton, 1898. See Price, 1939)*Scombroid host* : *Gymnosarda pelamys* [= *Katsuwonus pelamis* (Linnaeus)]*Locality* : Martha's Vineyard, Mass. U.S.A.*Non-scombroid hosts* : None.*Location* : Gills.**Genus CAPSALOIDES** Price, 1936[(Syn. *Capsala* Bosc, 1811, in part ; *Tristoma* Cuvier, 1817 in part ; *Calaslodes* Price, 1936 (typographical error)]**Capsaloides perugiai** (Setti, 1898)(Syn. *Tristoma perugiai* Setti, 1894)*Scombroid host* : *Tetrapterus belone* Rafinesque*Locality* : Spezia, Mediterranean.**Capsaloides cornuatus** (Verrill, 1875)(Syn. *Tristoma cornuatum* Verrill, 1875)*Scombroid host* : *Tetrapterus albidus* [= *Tetrapturus albidus* Poey]]*Locality* : Block Island, N. America (N.W. Atlantic).*Non-scombroid hosts* : None.*Location* : ? On body.**Capsaloides megaspinosus**\* Price, 1939*Scombroid host* : *Tetrapterus imperator* [= *Tetrapturus belone* Rafinesque]*Locality* : Woods Hole, Massachusetts, U.S.A. (N.W. Atlantic).*Non-scombroid hosts* : None.*Location* : Nares.

*Remarks* : For long the host *T. imperator* (Bloch and Schneider), had remained a problematic species, the status of which has been well clarified in a recent work by Robins and de Sylva (1960). It is shown that the species has been confused with *T. belone*, but in fact, Schneider's *imperator* was based on a poor drawing of a juvenile specimen of *Xiphias gladius* Linnaeus. However, in the present case, there can be no doubt that the host meant could be anything other than *T. belone*.

**Capsaloides sinuatus** (Goto, 1894) emend. Price, 1938(Syn. *Tristomum sinuatum* Goto, 1894)*Scombroid host* : *Histiophorus* sp. [= *Istiophorus gladius* (Broussonnet)]*Locality* : Misaki, Japan, Pacific.*Non-scombroid hosts* : None.*Location* : Gills.

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\* Sproston (1946) emended the spelling of this species as *C. magnaspinosa*.



Genus *TRISTOMA* Cuvier, 1817

(Syn. *Capsala* Bosc, 1811 in part)

*Tristoma integrum* Diesing, 1836

(Syn. *Tristoma coccineum* Cuvier, 1817 in part ; *T. coccineum* Cuvier of Taschenberg, 1879 ; *T. rotundum* Goto, 1894)

*Scombroid host* : *Xiphias gladius* Linnæus

*Locality* : Genova, Naples, Messina, Venice (Adriatic and Mediterranean) ; U.S. Coast of N.W. Atlantic ; Japan (Pacific).

*Non-scombroid hosts* : None.

*Remarks* : See Price (1939) for differences between genotype *T. coccineum* and *T. integrum*; also Dawes (1946).

*Tristoma coccineum* Cuvier, 1817

[Syn. *Tristomum papillosum* Diesing, 1836 ; *Capsala papillosa* (Diesing) of Nordmann, in Lamark, 1840]

*Scombroid host* : *Xiphias gladius* Linnæus

*Locality* : Atlantic.

*Non-scombroid host* : Hammerhead shark (Woods Hole, Massachusetts, U.S.A.)

*Location* : Gills in *X. gladius*.

*Tristoma levinsenii* Monticelli

*Scombroid host* : *Thynnus* sp. (= *Thunnus* sp.)

*Locality* : Mediterranean.

Suborder : POLYOPISTHOCOTYLEA

Superfamily : DICLIDOPHORIDEA

FAMILY : MAZOCRAEIDAE

Genus *KUHNIA* Sproston, 1945

(Syn. *Octostoma* Kuhn, 1829, nec Otto, 1823 ; *Octobothrium* Leucart, 1827 of Leuckart, 1842 in part ; *Octocotyle* Diesing, 1850 in part, nec Goto, 1894 ; *Octoplectanum* Diesing, 1858, in part)

*Kuhnia scombri* (Kuhn, 1829), Sproston, 1945

[Syn. *Octostoma scombri* Kuhn, 1829 ; *Octobothrium scombri* (Kuhn) of Nordmann, 1832 and other writers ; *Octocotyle scombri* of Dujardin, 1845 ; *O. truncata* Diesing, 1850 ; *Octoplectanum truncatum* of Diesing, 1858 ; *Pleurocotyle scombri* of Taschenberg, 1878 ; *Octocotyle major* Goto, 1894 ; *Octocotyle scombri*, of Nicoll, 1915 ; *Mazocraes* (*Octobothrium*) *scombri* of Baylis, 1939]

*Scombroid hosts* : 1. *Scomber scombrus* Linnæus

2. *Pneumatophorus colias* [= *Scomber japonicus colias* Gmelin]

3. *Rastrelliger kanagurta* (Cuvier)

4. Mackerel

5. *Scomber japonicus japonicus* Hottuyun

*Localities* : 1 & 2. North Sea, English Channel, Eastern Atlantic, Mediterranean and Vladivostock ; 3. Macassar, Celebes ; 4. Newport, U.S.A., N.W. Atlantic ; 5. Japanese waters (Misaki, Japan).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : For details of variations in this species reference may be made to Sproston (1945), Dawes (1946), and Yamaguti (1953).

**Kuhnia minor** (Goto, 1894) Sproston, 1945, 1946

(Syn. *Octocotyle minor* Goto, 1894)

*Scombroid host* : *Scomber colias* [= *Scomber japonicus japonicus* Hottuyun or ? *Scomber japonicus colias* Gmelin]

*Locality* : Hagi, and Misaki, Japan.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Although *Scomber colias* is mentioned as the host, in all probability it may be the typical race of *S. japonicus* rather than *S. japonicus colias*, that could be the original host species, as the type locality of the former is Nagasaki, Japan. Kishinouye (1923) remarks that two types of *S. japonicus* occurs in Japanese waters, a deeper bodied form commonly known as 'hirasaba', and a rounded bodied form known as 'marusaba'. Slight differences in finray counts are said to exist, but it is not known whether these as well as the differences in body form has anything to do with the different size groups of the typical race.

**Kuhnia macracanthus** (Meserve, 1838)

(Syn. *Mazocras macracanthus* Meserve, 1938)

*Scombroid host* : 'An unidentified species of mackerel.'

*Locality* : Tagus Cove, Albermarle Isl., Galapagos Isles (E. Pacific).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : The host identification is incomplete. However, from the pattern of distribution of mackerels, it is likely that the host could be a race of *Scomber japonicus*.

#### FAMILY : DISCOCOTYLIDÆ

##### Subfamily : DISCOCOTYLINÆ

Genus GRUBEA Diesing, 1858

(erected for '*Octobothrium scombri* Nordmann' of Grube, 1855)

**Grubea cochlear** Diesing, 1858

(Syn. *Pleurocotyle scombri* of Pratt, 1900)

*Scombroid host* : *Scomber scombrus* Linnæus

*Locality* : Naples, Mediterranean.

*Non-scombroid host* : *Trachurus trachurus* (Linnæus) (Mediterranean).

*Location* : Gills.

## FAMILY : GASTROCOTYLIDÆ

I have followed Hargis (1956) in recognising Gastrocotylidæ as a distinct family with the subfamilies Gastrocotylinæ, Vallisiinæ, and Priceinæ.

## Subfamily : GASTROCOTYLINÆ

Genus GASTROCOTYLE van Beneden and Hesse, 1863

**Gastrocotyle japonica** Ishii and Sawada, 1938 emend. Sproston, 1946

*Scombroid host* : *Scomber japonicus* [= *Scomber japonicus japonicus* Hottuyun]

*Locality* : Japan, Pacific.

*Non-scombroid hosts* : None.

*Location* : Gills.

Genus PSEUDAXINE Parona and Perugia, 1890

**Pseudaxine katsuwonis** Ishii, 1936

*Scombroid host* : *Katsuwonus vagans* [= *Katsuwonus pelamis* (Linnæus)]

*Locality* : Japan, Pacific.

*Non-scombroid hosts* : None.

*Location* : Gills.

**Pseudaxine mexicanus** Meserve, 1938

*Scombroid host* : 1. *Scomberomorus maculatus* (Mitchill)

2. *Scomberomorus cavalla* (Cuvier)

3. *Scomberomorus maculatus* (Mitchill)

*Localities* : 1. Tangola-Tangola, Mexico (Pacific Coast) ; 2 & 3. Gulf of Mexico.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : See Hargis (1956) and also addendum-II.

**Pseudaxine texana** Koratha, 1955

*Scombroid host* : *Scomberomorus maculatus* (Mitchill)

*Locality* : Texas Coast, U.S.A. (Atlantic).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Hargis (1956) opines that *P. texana* could probably be a synonym of *P. mexicanus*, but as the description and figures given by Koratha (1955) are inadequate to settle this question, both are treated as distinct.

**Pseudaxine vagans** Ishii, 1936

*Scombroid host* : *Katsuwonus vagans* [= *Katsuwonus pelamis* (Linnæus)]

*Locality* : Japan, Pacific.

*Non-scombroid hosts* : None.

*Location* : Gills.

Genus **LITHIDOCOTYLE** Sproston, 1946, emend. Hargis, 1956

**Lithidocotyle acanthophallus** (MacCallum and MacCallum, 1913), Sproston 1946  
(Syn. *Microcotyle acanthophallus* MacCallum and MacCallum, 1913)

*Scombroid host* : *Scomberomorus cavalla* (Cuvier)

*Scomberomorus maculatus* (Mitchill)

*Localities* : Alligator Harbour, Florida, Tampa Bay, Florida, and Grand Isle, Louisiana, U.S.A. (Atlantic).

*Non-scombroid hosts* : *Roccus saxatilis* (= *R. lineatus*) (New York Aquarium ? or New York fish market ?).

*Location* : Gills.

*Remarks* : Refer to rediagnosis of certain characters given by Hargis (1956), who also draws attention to the possibility of *Microcotyle scomberomori* Koratha (1955) being a synonym of this species, but as the original descriptions and figures of *M. scomberomori* are inadequate to settle this question, they are treated at present as distinct.

**Lithidocotyle secundus** Tripathi, 1954

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Puri, Orissa Coast, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

Genus **PSEUDOMICROCOTYLE** Sanders, 1947**Pseudomicrocotyle elagatis** Sanders, 1947

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid host* : *Elagatis bipinnulata* [Australia].

*Location* : Gills.

*Remarks* : Sanders (1947) did not assign his genus to any subfamily, but Tripathi (1954) on the basis of its affinities to *Thoracocotyle*, *Pricea*, and *Lithidocotyle* relegated it to the subfamily Gastrocotylinae. Incidentally, *Pricea* is now placed under a separate subfamily Pricinae.

Ramalingam (1951) mentions *S. g. guttatus* (as *Cybium guttatum*) as a host of *P. elagatis*, but offers no further comments. In view of the fact that monogenetic trematodes are more host specific and are rarely met with in host species of different families, it would have been desirable to know of variations if any in this parasite species from such widely different hosts.

## Genus NEOTHORACOCOTYLE Hargis, 1956

**Neothoracocotyle acanthocybii** (Meserve, 1938)  
(Syn. *Gotocotyle acanthocybii* Meserve, 1938)

*Scombroid host* : *Acanthocybium solandri* (Cuvier and Valenciennes)

*Locality* : Galapagos Islands (E. Pacific).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : See Hargis (1956) for partial rediagnosis of species.

## Genus GOTOCOTYLEA Ishii, 1936 emend. Hargis, 1956

**Gotocotylea sawara** Ishii, 1936

*Scombroid host* : Sawara, *Cybium niphonium* [= *Scomberomorus niphonius* (Cuvier and Valenciennes)]

*Locality* : Japan, Pacific.

*Non-scombroid hosts* : None.

*Location* : Gills.

## Genus SCOMBEROCOTYLE Hargis, 1956

**Scomberocotyle scomberomori** (Koratha, 1955), Hargis, 1956  
(Syn. *Heteraxine scomberomori* Koratha, 1955)

*Scombroid host* : *Scomberomorus maculatus* (Mitchill)

*Locality* : Texas Coast, Atlantic.

*Non-scombroid host* : None.

*Location* : Gills.

*Remarks* : See Hargis (1956) for rediagnosis of species as well.

## Genus THORACOCOTYLE MacCallum, 1913, emend. Hargis, 1956

**Thoracocotyle crocea** MacCallum, 1913, Sproston, 1946  
(Syn. *Thoracocotyle paradoxica* Meserve, 1938 ; ? *Thoracocotyle paradoxica* Pearse, 1949)

*Scombroid hosts* : 1. *Scomberomorus maculatus* (Mitchill)

2. ? *Scomberomorus cavalla* (Cuvier)

*Localities* : 1. New York Aquarium (MacCallum, 1913); Tangola-Tangola, Mexico (Meserve, 1938); Alligator Harbour, Florida (Hargis, 1956) (Atlantic and Central Eastern Pacific); 2. ? Beaufort, North Carolina, U.S.A. (Pearse, 1949) (Atlantic).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Hargis (1956) gives reasons for considering *T. paradoxica* a synonym of *T. crocea*, thereby extending the distribution of the latter species to the Pacific. Pearse's specimens were obtained from *Scomberomorus cavalla*, although erroneously he mentioned that 'It occurred in the same host as Meserve's species' (*S. maculatus*). Hargis (1956) while drawing attention to this discrepancy comments that perhaps Pearse's *T. paradoxica* could be the same as *T. crocea*.

**Thoracocotyle ovale** Tripathi, 1954

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Puri, Orissa Coast, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

**Thoracocotyle sp.** Ramalingam, 1951

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Name only. See Ramalingam (1951).

## Subfamily : PRICINÆ

## Genus : PRICEA Chauhan, 1945

**Pricea armatum** Ramalingam, 1951

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Known from a single specimen obtained after examining five host specimens (Ramalingam, 1951).

**Pricea melane** Ramalingam, 1951

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Known from a single specimen obtained after examining four host specimens (Ramalingam, 1951).

**Pricea minima** Chauhan, 1945

*Scombroid host* : *Thynnus pelamys* [= ? *Katsuwonus pelamis* (Linnæus)]

*Locality* : Bombay, India (Arabian Sea).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : The host record needs confirmation as the Oceanic skipjack *Katsuwonus pelamis* is rarely ever landed at Bombay. On the other hand, *Euthynnus affinis affinis*, and *Kishinoueella tonggol*, the little tunny and the northern bluefin tuna respectively, are usually landed at

Bombay. Hence, in the list on 'hosts and parasites' given at the end of this section, I have placed *P. minima* with a query under *K. pelamis*.

***Pricea minutum* Ramalingam, 1951**

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Known from a single specimen obtained after examining three host specimens (Ramalingam, 1951).

***Pricea microcotylæ* Chauhan, 1945**

*Scombroid host* : *Scomber microlepidotus* [= *Rastrelliger kanagurta* (Cuvier)]

*Locality* : Bombay, India (Arabian Sea).

*Non-scombroid hosts* : None.

*Location* : Gills.

***Pricea multæ* Chauhan, 1945**

*Scombroid host* : 1. *Cybium lanceolatus* (= *Scomberomorus* sp.) See remarks.

2. *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Localities* : 1. Bombay, India (Arabian Sea) (Chauhan, 1945); 2. Madras, India (Bay of Bengal) (Ramalingam, 1951).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : *P. multæ* is the genotype and was described from a single specimen obtained from '*Cybium lanceolatum*'. I am not aware of any species of *Cybium* (= *Scomberomorus*) with this name. Quite likely, Chauhan has erroneously used '*lanceolatus*' for *Scomberomorus lineolatus* (Cuvier and Valenciennes)! Three species of *Scomberomorus*, namely, *S. commerson* (Lacépède), *S. g. guttatus* (Bloch and Schneider), and *S. lineolatus* are at present known to occur along the Indian coast (Jones and Silas, 1961) and Ramalingam (1951) records *P. multæ* (no description) from *S. g. guttatus*. While admitting that the same species could occur on two, or more closely related host species, it is my contention that the 'host type' could be any one of these three and as such until confirmed on further material I have indicated the first mentioned host as corresponding to *Scomberomorus* sp.

***Pricea robusta* Ramalingam, 1951**

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Known from many specimens obtained from three host specimens (Ramalingam, 1951).

**Pricea tetracanthum** Ramalingam, 1951

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Known from a single specimen obtained after examining seven host specimens (Ramalingam, 1951).

**Pricea triacanthum** Ramalingam, 1951

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Known from a single specimen obtained after examining six host specimens (Ramalingam, 1951).

**FAMILY : MICROCOTYLIDÆ****Subfamily : MICROCOTYLINÆ**

**Genus : MICROCOTYLE** Beneden and Hesse, 1863

**Microcotyle scomberomori** Koratha, 1955

*Scombroid host* : *Scomberomorus maculatus* (Mitchill)

*Locality* : Texas Coast, U.S.A.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Hargis (1956) opines that it is very probable that *Microcotyle scomberomori* Koratha, 1955, is a synonym of *Lithidocotyle acanthophallus* (MacCallum and MacCallum).

**Microcotyle** sp. Ramalingam, 1951

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)].

*Locality* : Madras, India (Bay of Bengal).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Name only. See Ramalingam (1951).



## FAMILY : HEXOSTOMATIDÆ

Genus : HEXOSTOMA Rafinesque, 1815

*nec Hexastoma* Rudolphi, 1809 ; *nec Hexastoma* Kuhn, 1828  
(Syn. *Hexocotyle* Blainville, 1828)

***Hexostoma auxidi* Palombi, 1943***Scombroid host* : *Auxis thazard* (Lacépède)*Locality* : Mediterranean.*Non-scombroid hosts* : None.*Location* : Gills.***Hexostoma pricei* Koratha, 1955***Scombroid host* : *Sarda sarda* (Bloch)*Locality* : Texas Coast, U.S.A.*Non-scombroid hosts* : None.***Hexostoma grossum* (Goto, 1894)**(Syn. *Hexocotyle grossa* Goto, 1894)*Scombroid hosts* : *Thynnus* sp. [= *Thunnus* sp.]*Parathunnus sibi* [= ? *Thunnus alalunga* (Bonnaterre) or ? *Thunnus* (*Parathunnus*) *obseus mebachi* (Kishinouye)]*Katsuwonus vagans* [= *Katsuwonus pelamis* (Linnæus)]*Thunnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]*Locality* : Japan, Pacific.*Non-scombroid host* : *Seriola quinqueradiata* [Japan].*Location* : Gills.*Remarks* : See Ishii and Sawada (1938) ; and Sproston (1946) for discussion on the species.***Hexostoma macracanthum* Fujii, 1944***Scombroid host* : *Euthynnus alletteratus* (Rafinesque)*Locality* : Tortugas, Florida.*Non-scombroid hosts* : None.*Location* : Gills.*Remarks* : This species may prove to be a synonym of *H. euthynni* Meserve (1938).***Hexostoma acutum* (Goto, 1894)**(Syn. *Hexocotyle acuta* Goto, 1894)*Scombroid host* : *Thynnus sibi* [= ? *Thunnus alalunga* (Bonnaterre) or ? *Thunnus* (*Parathunnus*) *obseus mebachi* (Kishinouye)] and *Thynnus thynnus* [= *Thunnus* (T.) *thynnus orientalis*].*Locality* : Hagi, Osatsube, Hokkaido, Japan.*Non-scombroid hosts* : None.*Location* : Gills.

**Hexostoma dissimilis** (Yamaguti, 1937)

*Scombroid host* : *Thynnus thynnus* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Locality* : Numadu, Siduoka Prefecture, Japan.

*Non-scombroid hosts* : None.

*Location* : Gills.

**Hexostoma extensicaudum** (Dawes, 1940)

(Syn. *Hexacotyle extensicauda* Dawes, 1940 ; ? *Hexacotyle* ? *acuta* (Goto) of Baylis, 1939)

*Scombroid host* : *Thunnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* Linnæus]

*Locality* : North Sea.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Dawes (1946) comments that the British form listed by Baylis (1939) as *Hexacotyle* ? *acuta* (Goto) is probably *H. extensicaudum*.

**Hexostoma euthynni** Meserve, 1938

*Scombroid host* : 1. *Euthynnus alletteratus* (= *Euthynnus affinis yaito* Kishinouye ? or *E. a. lineatus* Kishinouye ?)

2. *Euthynnus lineatus* (= *Euthynnus affinis lineatus* Kishinouye).

*Localities* : 1. James Island, Galapagos Islands, E. Pacific (Meserve, 1938); 2. Baja, California (Millemann, 1956).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : The host species, *E. alletteratus* as given by Meserve is incorrect as it is known only from the Atlantic. The Indo-Pacific representatives of *Euthynnus* may be said to fall under three subspecies of *E. affinis*, of which Galapagos Islands is within the distributional range of the two mentioned above. Millemann's collection of this parasite from *E. a. lineatus* would indicate that the host type could also be the same.

**Hexostoma thunninæ** (Parona and Perugia, 1889)

(Syn. *Octocotyle thunninæ* Parona and Perugia, 1889 ; *Octobothrium thunninæ* (Parona and Perugia) of St. Remy, 1891 ; *Hexocotyle thunninæ* (Parona and Perugia) of Goto, 1899)

*Scombroid hosts* : *Thunnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnæus)]

*Locality* : Genova, Italy, Mediterranean.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Palombi (1943) redescribed this species from the same host from the Mediterranean.

**Hexostoma thynni** (Delaroche, 1811), Rafinesque, 1815

(Syn. *Polystoma thynni* Delaroche, 1811 ; *P. duplicatum* Rudolphi, 1819 ; *Hexacotyle thynni* (Delaroche), Blainville, 1828 ; *Plagiopeltis duplicata* (Rudolphi) Diesing, 1850 ; ? *Hexacotyle thynni* (Delaroche) Linton, 1901 ; Summer *et al.* 1913).

*Scombroid host* : 1. Tunny, *Thunnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)], and *Sarda sarda* (Bloch)

2. *Sarda sarda* (Bloch)

*Localities* : 1. Mediterranean ; 2. Atlantic coast of North America.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Palombi (1943) redescribed this species from specimens taken from *Pelamys sarda* (= *Sarda sarda*) from the Mediterranean. The larvæ of *H. thynni* were described recently by Euzet (1956).

**HOST-PARASITE LIST No. I**

(List of names of scombroid hosts and their monogenetic trematode parasites. Genera are alphabetically arranged. (?) indicates doubtful record of parasite species from host)

HOST	PARASITE
<i>Acanthocybium solandri</i> (Cuvier and Valenciennes) .....	<i>Neothorocotyle acanthocybii</i> (Meserve)
<i>Auxis thazard</i> (Lacépède) .....	<i>Hexostoma auxidi</i> Palombi
<i>Euthynnus affinis affinis</i> (Cantor) .....	<i>Capsala gouri</i> Chauhan ? <i>Pricea minimæ</i> Chauhan
<i>Euthynnus affinis lineatus</i> Kishinouye .....	<i>Hexostoma euthynni</i> Meserve
<i>Euthynnus affinis yaito</i> Kishinouye .....	? <i>Hexostoma euthynni</i> Meserve
<i>Euthynnus alletteratus</i> (Rafinesque) .....	<i>Capsala maccallumi</i> Price <i>Capsala manteri</i> Price <i>Hexostoma macracanthum</i> Fujii
<i>Istiophorus gladius</i> (Broussonnet) .....	? <i>Capsala megacotyle</i> (von Linstow) <i>Capsala ovalis</i> (Goto) <i>Capsaloides sinuatus</i> (Goto)
<i>Katsuwonus pelamis</i> (Linnaeus) .....	<i>Capsala interrupta</i> (Monticelli) <i>Capsala katsuwoni</i> Ishii <i>Capsala lævis</i> (Verrill) <i>Capsala lintoni</i> Price <i>Capsala nozawæ</i> (Goto) <i>Capsala pelamydis</i> (Taschenberg) <i>Hexostoma grossum</i> (Goto) ? <i>Pricea minimæ</i> Chauhan <i>Pseudaxine katsuwoni</i> Ishii <i>Pseudaxine vagans</i> Ishii
'Mackerel' .....	<i>Kuhnia scombri</i> (Kuhn)

' Mackerel—unidentified species of' .....	<i>Kuhnia macracanthus</i> Meserve
<i>Makaira</i> spp. ....	? <i>Capsala megacotyle</i> (von Linstow) ? <i>Capsala ovalis</i> (Goto)
<i>Makaira indica</i> (Cuvier) .....	<i>Capsala laevis</i> (Verrill)
<i>Rastrelliger kanagurta</i> (Cuvier) .....	<i>Kuhnia scombri</i> (Kuhn) <i>Pricea microcotylæ</i> Chauhan
<i>Sarda orientalis</i> (Temminck and Schlegel) .....	<i>Capsala caballerio</i> Winter
<i>Sarda sarda</i> (Bloch) .....	<i>Capsala pelamydis</i> (Taschenberg) <i>Hexostoma pricei</i> Koratha <i>Hexostoma thynni</i> (Delaroche)
<i>Scomber japonicus japonicus</i> Hottuyn .....	<i>Dactylogyrus inversus</i> Goto and Kikuchi <i>Gastrocotyle japonicus</i> Ishii and Sawada <i>Kuhnia scombri</i> (Kuhn) ? <i>Kuhnia macracanthus</i> Meserve
<i>Scomber japonicus colias</i> Gmelin .....	? <i>Kuhnia macracanthus</i> Meserve <i>Kuhnia scombri</i> (Kuhn)
<i>Scomber scombrus</i> Linnæus .....	<i>Kuhnia minor</i> (Goto) <i>Kuhnia scombri</i> (Kuhn) <i>Grubea cochlear</i> Diesing
<i>Scomberomorus cavalla</i> (Cuvier) .....	<i>Lithidocotyle acanthophallus</i> (MacCallum and MacCallum) <i>Pseudaxine mexicana</i> Meserve <i>Thoracocotyle corcea</i> MacCallum
<i>Scomberomorus commerson</i> (Lacépède) .....	? <i>Pricea multæ</i> Chauhan
<i>Scomberomorus guttatus guttatus</i> (Bloch and Schneider) .....	<i>Lithidocotyle secundus</i> Tripathi <i>Mictocotyle</i> sp. Ramalingam <i>Pricea armatum</i> Ramalingam <i>Pricea melane</i> Ramalingam <i>Pricea minutum</i> Ramalingam <i>Pricea multæ</i> Chauhan <i>Pricea robustum</i> Ramalingam <i>Pricea tetracanthum</i> Ramalingam <i>Pricea triacanthum</i> Ramalingam <i>Thoracocotyle ovale</i> Tripathi <i>Thoracocotyle</i> sp. Ramalingam
<i>Scomberomorus lineolatus</i> (Cuvier and Valenciennes) .....	? <i>Pricea multæ</i> Chauhan
<i>Scomberomorus maculatus</i> (Mitchill) .....	<i>Lithidocotyle acanthophallus</i> (MacCallum and MacCallum) <i>Microcotyle scomberomori</i> Koratha <i>Pseudaxine mexicana</i> Meserve

	<i>Pseudaxine texana</i> Koratha <i>Scomberocotyle scomberomori</i> (Koratha) <i>Thoracocotyle crocea</i> MacCallum
<i>Scomberomorus niphonius</i> (Cuvier and Valenciennes) .....	<i>Capsala ovalis</i> (Goto) <i>Gotocotylea sawara</i> Ishii
<i>Scomberomorus</i> sp. (= <i>Cybium lanceolatus</i> )....	<i>Pricea multæ</i> Chauhan
<i>Tetrapturus amplus</i> (Poey).....	<i>Capsala poeyi</i> (Vigueras)
<i>Tetrapturus albida</i> (Poey).....	<i>Capsala lævis</i> (Verrill) <i>Capsaloides cornuatus</i> (Verrill)
<i>Tetrapturus belone</i> Rafinesque.....	<i>Capsala lævis</i> (Verrill) <i>Capsaloides perugini</i> (Setti)
<i>Thunnus</i> ( <i>Neothunnus</i> ) <i>albacares albacares</i> (Bonnaterre) .....	<i>Capsala thynni</i> (Guiart)
<i>Thunnus</i> ( <i>Neothunnus</i> ) <i>albacares macroptera</i> (Temminck and Schlegel).....	<i>Capsala biparasitica</i> (Goto)
<i>Thunnus</i> ( <i>Parathunnus</i> ) <i>obesus mebachii</i> (Kishinouye) .....	? <i>Capsala nozawæ</i> (Goto) ? <i>Hexostoma acutum</i> (Goto)
<i>Thunnus</i> ( <i>Parathunnus</i> ) <i>obesus obesus</i> Lowe....	<i>Capsala onchidiocotyle</i> (Setti)
<i>Thunnus</i> ( <i>Thunnus</i> ) <i>alalunga</i> (Bonnaterre).....	? <i>Capsala nozawæ</i> (Goto) <i>Capsala thynni</i> (Guiart) <i>Hexostoma acutum</i> (Goto) <i>Hexostoma grossum</i> (Goto)
<i>Thunnus</i> ( <i>Thunnus</i> ) <i>thynnus orientalis</i> (Temminck and Schlegel) .....	<i>Capsala magronum</i> (Ishii) <i>Capsala nozawæ</i> (Goto) <i>Hexostoma dissimilis</i> (Yamaguti) <i>Hexostoma grossum</i> (Goto)
<i>Thunnus</i> ( <i>Thunnus</i> ) <i>thynnus thynnus</i> (Linnæus)..	<i>Capsala interrupta</i> (Monticelli) ? <i>Capsala nozawæ</i> (Goto) <i>Capsala onchidiocotyle</i> (Setti) <i>Hexostoma acuta</i> (Goto) <i>Hexostoma extensicaudum</i> (Dawes) <i>Hexostoma thunninæ</i> Parona and Perugia <i>Hexostoma thynni</i> (Delaroche)
<i>Thunnus</i> sp.....	<i>Hexostoma grossum</i> (Goto) <i>Tristoma levinseni</i> Monticelli
<i>Xiphias gladius</i> Linnæus.....	<i>Capsala lævis</i> (Verrill) <i>Tristomum coccineum</i> Cuvier <i>Tristomum integrum</i> Diesing

## DIGENETIC TREMATODES

## ORDER DIGENEA

## Suborder GASTEROSTOMATA

## FAMILY : BUCEPHALIDÆ

## Subfamily : BUCEPHALINÆ

## Genus BUCEPHALUS Baer, 1826

(Syn. *Gastrostomum* Siebold 1848 ; *Eubucephalus* Diesing 1885)***Bucephalus heterotentaculatus* Bravo-Hollis and Sogandares-Bernal, 1956***Scombroid host* : *Scomberomorus sierra* Jordan and Starks [= *Scomberomorus maculatus* (Mitchill)]*Locality* : Pacific coast of Mexico.*Non-scombroid hosts* : None.*Location* : Intestine.***Bucephalus jaggannathi* Verma 1936***Scombroid host* : *Cybium guttatum*. [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]*Locality* : Bay of Bengal.*Non-scombroid hosts* : None.*Location* : In intestines of Adults.

## Genus RHIPIDOCOTYLE Diesing 1858

(Syn. *Nannoenterum* Ozaki, 1924)***Rhipidocotyle adbaculum* Manter, 1940***Scombroid host* : *Scomberomorus regalis* [= *Scomberomorus regalis* (Bloch)]*Locality* : Florida Coast, U.S.A.*Non-scombroid hosts* : None.***Rhipidocotyle angusticollis* Chandler, 1941***Scombroid host* : *Sarda sarda* [= *Sarda sarda* (Bloch)]*Locality* : Texas Coast, U.S.A.*Non-scombroid hosts* : None.***Rhipidocotyle baculum* (Linton, 1905) Eckmann, 1932**(Syn. *Gastrostomum Baculum* Linton ; *Nannoenterum Baculum* Linton)*Scombroid hosts* : *Scomberomorus maculatus* [= *Scomberomorus maculatus* (Mitchill)]*Scomberomorus regalis* ? [= *Scomberomorus regalis* (Bloch) ?]*Localities* : Beaufort, North Carolina ; Florida, U.S.A.*Non-scombroid hosts* : None.

**Rhipidocotyle capitatum** (Linton, 1940)

*Scombroid host* : *Auxis rochei* [= *Auxis thazard* (Lacépède)]  
*Euthynnus alletteratus* (Rafinesque)

*Locality* : Woods Hole, Massachusetts, U.S.A.

*Non-scombroid hosts* : *Holocentrus ascensionis* [Bahamas, Atlantic] see Sparks (1957)

**Rhipidocotyle nagaty** Manter, 1940

*Scombroid host* : *Euthynnus alletteratus* [= *Euthynnus alletteratus* (Rafinesque)]

*Locality* : Florida, U.S.A.

*Non-scombroid hosts* : None.

*Remarks* : *R. nagaty* and *R. capitatum* are very closely related and may prove to be conspecific.

**Rhipidocotyle pentagonum** (Ozaki, 1924)

(Syn. *Nannoenterum pentagonum* Ozaki)

*Scombroid hosts* : 1. *Scomberomorus nipponicus* [= *Scomberomorus niphonius* (Cuvier & Valenciennes)]

2. *Thynnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)].

*Localities* : 1. Takamatsu, Shikoku Islands, Japan, Pacific Ocean ; 2 Mediterranean.

*Non-scombroid hosts* : *Caranx* sp., *Caranx compressus* [Red Sea].

*Remarks* : See also Eckmann (1932) and Nagaty (1937)

**Rhipidocotyle septapapillata** Krull, 1934

*Scombroid host* : *Thynnus thynnina* [= *Euthynnus affinis affinis* (Cantor)]

*Locality* : Red Sea.

*Non-scombroid hosts* : *Chrysophrys berda* [Bombay, India] ; *Eupomotis gibbosus*, *Fundulus diaphanus* [Virginia, U.S.A.].

*Remarks* : Also refer Nagaty (1937).

## Subfamily : PROSORHYNCHINÆ

Genus *BUCEPHALOPSIS* Diesing, 1855

(Syn. *Bucephaloides* Hopkins ; *Prosorhynchoides* Dollfus)

**Bucephalopsis arcuata** (Linton, 1900)

(Syn. *Gasterostomum arcuatum* Linton ; *G. pusillum* Stafford ; *Bucephalopsis pusilla* (Stafford))

*Scombroid hosts* : *Sarda sarda* [= *Sarda sarda* (Bloch)]

*Scomberomorus regalis* [= *Scomberomorus regalis* (Bloch)]

*Localities* : Woods Hole ; Beaufort, North Carolina.

*Non-Scombroid hosts* : *Caranx hippos* ; *Trichiurus lepturus* ; *Gadus morrhna* ; *Sphyraena barracuda*. [Woods Hole ; Beaufort, N. Carolina ; and Florida, U.S.A.]. *Brevoortia tyrannus* ; *Carcharhinus obscurus* [Atlantic coast of Panama ; Bahamas ; Puerto Rico].

*Remarks* : Also see Sumner *et al.* (1913). *B. arcuata* has been found to occur in the pylorus, stomach, intestine and pyloric caeca of *S. sarda*. For detailed discussion on *B. arcuata* see Sogandares-Bernal and Sogandares (1961) and Ward (1954).

***Bucephalopsis cybii* Park, 1939**

*Scombroid host* : (1) *Cybium coreanum* [= *Scomberomorus guttatus koreanus* (Kishinouye)]  
(2) *Sarda orientalis* (Temminck and Schlegel).  
(3) *Scomberomorus* sp.

*Locality* : 1. Korean waters ; 2. & 3. Pacific coast of Mexico (Bravo-Hollis and Sogandares-Bernal 1956).

*Non-scombroid hosts* : *Acanthogobius hastata* (Korean waters).

*Remarks* : Chauhan (1943) does not refer to this as well as the following species in his 'key' to the species of *Bucephalopsis*.

***Bucephalopsis sibi* Yamaguti, 1940**

*Scombroid host* : *Thynnus thynnus* [= *Thunnus* (T.) *thynnus orientalis* (Temminck & Schlegel)]

*Locality* : Hamazima, Japan.

*Non-scombroid hosts* : None.

**Suborder : PROSTOMATA**

**FAMILY : FELLODISTOMIDAE**

**Subfamily : TERGESTIINAE**

**Genus TERGESTIA Stossich, 1899**

(Syn. *Cithara* MacCallum ; *Theledera* Linton)

***Tergestia laticollis* (Rudolphi, 1819) Stossich 1899**

***Scomber scombrus* Linnaeus**

*Scombroid hosts* : *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn]

*Auxis thazard* [= *Auxis thazard* (Lacépède)], and

*Euthynnus alletteratus* [= *Euthynnus alletteratus* (Rafinesque)]

*Localities* : Japan ; Florida, U.S.A.

*Non-scombroid hosts* : *Caranx trachurus* [Naples and Arimini] ; *Trachurus trachurus* ; *Apogon lineatus* [Japan].

*Location* : Intestine.

*Remarks* : See Dawes (1946) and Baylis (1939).

***Tergestia acanthocephala* (Stossich, 1887)**

*Scombroid host* : *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn].

*Locality* : Toyama Bay, Japan.

*Non-scombroid hosts* : *Belone acus* [Trieste, Mediterranean] ; *Trachurus trachurus*, *Apogon lineatus* [Pacific Coast, Japan].

*Location* : Intestine.



## FAMILY : OPISTHORCHIIDAE

## Subfamily : APHALLINAE

## Genus APHALLUS POCHE, 1826

**Aphallus tubaium** (Rudolphi, 1819)

*Scombroid host* : *Scomber japonicus* (= ? *Scomber japonicus colias* Gmelin).

*Locality* : Adriatic, Mediterranean.

*Non-scombroid hosts* : *Sciaena umbra* [Speiza, Mediterranean : Poche, 1926] ; *Dentex dentex*, *Morone labrax* [Adriatic, Mediterranean : Janiszewsk, 1953].

*Location* : Intestine.

*Remarks* : Dollfus (1951) found the metacercaria of this species encysted in *Gobius (Zostericola) ophicephalus*. Scombroid host record is by Janiszewska (1953).

## FAMILY : ALLOCREADIIDAE

## Subfamily : ALLOCREADIINAE

## Genus DECEMTESTIS Yamaguti, 1934

**Decemtestis biacetabulatus** Srivastava, 1936

*Scombroid host* : *Scomber micropeditorus* [= *Rastrelliger kanagurta* (Cuvier)]. (*microlepidotus* misspelt as *micropeditorus*).

*Locality* : India.

*Non-scombroid hosts* : None.

## Genus HELICOMETRINA Linton, 1910

**Helicometrina orientalis** Srivastava, 1936

*Scombroid host* : *Scomber micropeditorus* [= *Rastrelliger kanagurta* (Cuvier)]. (*microlepidotus* misspelt as *micropeditorus*).

*Locality* : Bay of Bengal, India.

*Non-scombroid hosts* : None.

Genus **PODOCOTYLE** (Dujardin, 1845 : subgeneric name) Odhner, 1905  
(Syn. *Sinistroporus* Stafford, 1904 ; *Podocotyloides* Yamaguti, 1934)

**Podocotyle simplex** (Rudolphi, 1809) Stafford, 1904  
(Syn. *Distomum simplex* Rudolphi)

*Scombroid host* : *Scomber scombrus* [= *Scomber scombrus* Linnaeus].

*Locality* : Atlantic coast of Canada.

*Non-scombroid hosts* : *Gadus aeglefinus*, *Acanthocottus scorpins*, *Salmo salar*, *Sebastes marinus*, *Gastrosteus aculeatus*, *Phycis chuss*, *Hemitripterus americanus*, *Leptocephalus conger*, *Limanda ferruginea*, *Microgadus tomcod* [Canada ; Woods Hole, U.S.A.].

*Location* : Generally intestine and pyloric caeca.

## Subfamily : LEPOCREADIINAE

Genus LEPOCREADIUM Stossich, 1904  
(Syn. *Lepotrema* Ozaki, 1932)

**Lepocreadium retrusum** Linton, 1940

*Scombroid host* : *Pneumatophorus grex* [= *Scomber japonicus japonicus* Houttuyn].

*Locality* : Woods Hole, Massachusetts, U.S.A.

*Non-scombroid hosts* : None.

Genus OPECHONA Looss, 1907  
(Syn. *Pharyngora* Lebour 1908, *Prodistomum* Linton 1910)

**Opechona bacillaris** (Molin, 1859) Looss, 1907

(Syn. *Distoma bacillare* Molin, 1859 ; *Distoma* (*Dicrocoelum*) *bacillare* (Molin) Stossich, 1886 ; *Pharyngora bacillaris* Nicoll, 1914)

*Scombroid host* : *Scomber scombrus* [= *Scomber scombrus* Linnaeus]

*Scomber japonicus* [= *Scomber j. colias* Gmelin]

*Locality* : Mediterranean ; Atlantic.

*Non-scombroid hosts* : *Centrolophus pompilius* [Batavii] ; *Pleurobranchus pileus* [North America] ; *Gadus merlangus*, *Rhombus laevis*, *Onas mustela* [Lebour, 1908] ; *Cyclopterus lumpus*, *Clupea sprattus*, *C. larengus*, and *Capros aper* [Nicol, 1910]. See also Ward and Fellingham (1934), and Janiszewska (1953).

*Location* : Intestine and pyloric caeca.

*Remarks* : See also Dawes (1946).

**Opechona olssoni** (Yamaguti, 1934)

(Syn. *Pharyngora olssoni* Yamaguti, 1934)

*Scombroid host* : *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn].

*Locality* : Pacific coast of Japan and Toyama Bay.

*Non-scombroid hosts* : None.

*Location* : Stomach, intestine.

**Opechona orientalis** (Layman, 1930)

(Syn. *Pharyngora orientalis* Layman, 1930)

*Scombroid hosts* : 1. *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn].

2. Small mackerel [= *Scomber japonicus japonicus* Houttuyn ?].

3. *Scomber scombrus* Linnaeus.

*Localities* : 1. Peter the Great Bay, Sea of Japan (original description) ; 2. Galapagos Islands (small mackerel) ; Toyama Bay, Japan ; and Inland Sea of Japan ; 3. Adriatic, Mediterranean (Janiszewska 1953).

*Non-scombroid hosts* : *Angelichthys* (loc. unknown) ; *Paranthias furcifer* [Mexico] ; *Sphaeroides rubripes*, *Engraulis japonicus* [Toyama Bay, Japan] ; and *Girella nigricans* [California coast, U.S.A.].

*Location* : Stomach, intestine and pyloric caeca.

*Remarks* : See for more details Ward and Fellingham (1934).

**Opechona scombri** Yamaguti, 1938

**Scombroid hosts :** *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn]  
*Scomber kanagunta* [= *Rastrelliger kanagarta* (Cuvier)]. (*kanagarta* misspelt as *kanagunta*).

**Localities :** Inland Sea of Japan ; Macassar, Indonesia.

**Non-scombroid hosts :** None.

**Location :** Pyloric caeca, Intestine.

## Subfamily : OPECOELINAE

Genus OPECOELIDES Odhner, 1928

**Opecoelides vitellus** (Linton, 1900)

(Syn. *Distomum vitellus* Linton, 1900)

**Scombroid hosts :** *Scomber* [= *Scomber scombrus* Linnaeus]

*Sarda* [= *Sarda sarda* (Bloch)].

**Localities :** Woods Hole, Massachusetts, U.S.A.

**Non-scombroid hosts :** *Anguilla*, *Brevoortia tryannus*, *Clupea harengus*, *Cynoscion regalis*, *Decapterus macarellus*, *Leptocephalus conger*, *Limanda ferruginea*, *Lophopsetta maculata*, *Menticirrhus saxatilis*, *Merluccius bilinearis*, *Microgadus tomcod*, *Morone americana*, *Paralichthys dentatus*, *Paralichthys oblongus*, *Pomatomus saltatrix*, *Pomolobus pseudoharengus*, *Prionotus carolinus*, *Pseudopleuronectes americanus*, *Spheroides maculatus*, *Stenotomus chrysops*, *Tautoga onitis*, *Tautoglabrus adspersus*, and species of *Alosa*, *Ammodytes*, *Lagodon*, *Leiostomus*, *Mullus*, *Urophycis*, *Syrichtes*, *Trachinotus*, and *Trachurus* [Woods Hole, Massachusetts, U.S.A.].

**Location :** Generally intestine, pyloric caeca.

## FAMILY : ACANTHOCOLPIDAE

Subfamily : ACANTHOCOLPINAE

Genus TORMOPSOLUS Poche, 1926

**Tormopsolus orientalis** Yamaguti, 1934

Yamaguti (1934) described this species from the small intestine of *Seriola quinqueradiata*, and *S. aureovittata* from the Inland Sea and Mutu Bay, Japan ; and Pacific coast of Wakayama Prefecture and Toyama Bay, Japan, respectively. Later (1958) he referred to *Zonichthys fasciatus* from Bermuda, Atlantic as an additional host. However, Hanson (1950) lists the 'Bonito' and possibly *Zonichthys fasciatus* as hosts of *T. orientalis* from Bermuda. I am unable to find any other reference to the bonito [in Atlantic, *Sarda sarda* (Bloch)] listed as a host of *T. orientalis*, and feel that this may be a doubtful host record.

## FAMILY : HIRUDINELLIDAE

Genus HIRUDINELLA Garsin, 1730

**Hirudinella marina** (Garsin, 1730)*Scombroid host* : *Scomber pelamys* [= *Katsuwonus pelamis* (Linnaeus)]*Locality* : Not known.*Non-scombroid hosts* : None.*Location* : Stomach.

*Remarks* : Reference is invited to Nigrelli and Stunkard (1947), who on the basis of a thorough study of the genus *Hirudinella*, recognise only two species, *H. marina* and *H. ventricosa* (Pallas), the latter found only in the wahoo, *Acanthocybium solandri*, and also covers other species of *Hirudinella* hitherto reported from that fish. Yamaguti (1958) has listed six species of *Hirudinella*, some of which as pointed out by Nigrelli and Stunkard (1947) may be synonyms of *H. marina* or *H. ventricosa*. However, as Ward (1954) mentions, the difficulties of species discrimination in this genus is considerable which may be 'explained partly by the fact that never more than a few individuals are found in a single host, and also by the fact that the worms are so large and muscular that the arrangement of the internal organs is easily distorted.' The following list of species of *Hirudinella* as given by Yamaguti (1958) should be appraised in the light of the points raised above.

**Hirudinella beebei** Chandler, 1937*Scombroid host* : *Acanthocybium petus* [= *Acanthocybium solandri* (Cuvier and Valenciennes)].*Acanthocybium solandri* [= *Acanthocybium solandri* (Cuvier and Valenciennes)].*Localities* : Bermuda ; Galapagos Islands and Panama Bay.*Non-scombroid hosts* : None.*Location* : Stomach.**Hirudinella poirieri** (Moniez, 1891) Dollfus, 1935*Scombroid host* : *Thynnus alalonga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)].*Locality* : Atlantic.*Non-scombroid hosts* : None.*Location* : Stomach.**Hirudinella spinulosa** Yamaguti, 1938*Scombroid host* : *Thynnus alalonga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)].*Locality* : Pacific coast of Japan.*Non-scombroid hosts* : None.*Location* : Stomach.

**Hirudinella ventricosa** (Pallas, 1774) Baird, 1853

(Syn. *Fasciola ventricosa* Pallas, 1774 ; *Fasciola fusca* Bosc, 1902 ; *Fasciola coryphaenae hippur* Tilesius in Litt. Rudolphi 1809)

*Scombroid hosts* : *Xiphias gladius* [= *Xiphias gladius* Linnaeus].

*Locality* : Atlantic.

*Non-scombroid host* : *Coryphaena hippurus* [Amboyna; Europe; Florida]. See also Linton (1940) for hosts of *F. fusca* Bosc. Nigrelli (1938) reported this species from *X. gladius*.

**Hirudinella clavata** (Menzies, 1791) Blainville, 1928

(Syn. *Fasciola clavata* Menzies, 1791 ; *Distoma clavatum* Rudolphi)

*Scombroid hosts* : *Gymnosarda alletterata* [= *Euthynnus affinis yaito* Kishinouye].

*Pelamys sarda* [= *Sarda sarda* (Bloch)] ;

*Thynnus thynnus* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)] ;

*Thynnus vulgaris* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)] ;

*Xiphias gladius* [= *Xiphias gladius* Linnaeus].

*Localities* : Pacific Ocean ; Atlantic Ocean.

*Location* : Stomach.

*Remarks* : See for host species Manter (1940), and for a discussion on the parasite species Nigrelli (1938).

## FAMILY : BATHYCOTYLIDAE

Genus BATHYCOTYLE Adolf Darr, 1902

**Bathycotyle branchialis** Adolf Darr, 1902

*Scombroid host* : ? Mackerel [= *Scomber* sp.]

*Locality* : German East Africa (Pemba).

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Host identification is incomplete. See Dollfus (1932) for a detailed account on *B. branchialis*.

## FAMILY : HEMIURIDAE

Subfamily : HEMIURINAE

Genus HEMIURUS Rudolphi, 1809

(Syn. *Parahemiurus* Vaz and Pereira, 1930)

Yamaguti (1958) recognises the genus *Parahemiurus* Vaz and Pereira, 1930, but Dawes (1946) has pointed out that the main distinguishing feature between *Hemiurus*, and *Parahemiurus*, namely the bipartite nature of the seminal vesicle in the former and its undivided state in the latter are not sound characters for generic distinction, for 'In *Hemiurus levinseni*, the seminal vesicle has a non-muscular wall, and no doubt under certain conditions of extension or contraction of the body it may assume a variety of shapes, including that attributed to '*Parahemiurus*'.

'As such "All species of Vaz & Pereira's 'genus' are under suspicion of being species of *Hemiurus*, and many of them will prove to be known species insufficiently described' (Dawes 1946). On these grounds, until a thorough study could clarify the matter, *Parahemiurus* is treated here as a synonym of *Hemiurus*.

***Hemiurus appendiculatus* (Rudolphi, 1802) Looss, 1899**  
(Syn. *Apolema appendiculatum* Rudolphi, 1802 Blanchard, 1847)

*Scombroid host* : *Scomber scombrus* [= *Scomber scombrus* Linnaeus].

*Locality* : Woods Hole, Massachusetts, U.S.A.

*Non-scombroid hosts* : *Clupea alosa* [Europe] ; *Salmo salar*, *Osmerus mordax*, *Clupea harengus*, *Gadus collarius*, *Pollachius virens*, *Amodytes tobianus*, *Anguilla anguilla*, *Acanthocottus scorpins*, *Hippoglossus hippoglossus*, *Platystomatichthys hippoglossoides* [Canada], *Achirus fasciatus*, *Anchovia brownii*, *Brevoortia tyrannus*, *Clupanodon pseudohispanicus*, *Clupea harengus*, *Cynoscion regalis*, *Decapterus macrellus*, *Microgadus tomcod*, *Myxocephalus aeneus*, *Paralichthys dentatus*, *Pomolobus mediocris*, *P. pseudoharengus*, *Prionotus carolinus*, *Pseudopleuronectes americanus*, *Stenotomus chrysops*, *Trachurops crumenophthalmus*, *Urophycis chuss* [Woods Hole], *Gadus merlangus* [Australia] ; *Alosa finta* [Egypt-Mediterranean] ; *Caspialosa* spp. [Black Sea]. For additional hosts see Nicoll (1907), Mola (1928), Zschokke (1933).

*Location* : Stomach, intestine and oesophagus.

***Hemiurus sardiniae* (Yamaguti, 1934)**  
(Syn. *Parahemiurus sardiniae* Yamaguti, 1934)

*Scombroid hosts* : *Istiophorus orientalis* [= *Istiophorus gladius* (Broussonnet)]

*Locality* : Toyama Bay, Japan.

*Non-scombroid hosts* : *Sardinia melanosticta*, *Engraulis japonicus* [Toyama Bay, Japan].

*Location* : Stomach.

*Remarks* : See Manter (1940) wherein *Parahemiurus sardiniae* Yamaguti, is considered a probable synonym of *P. merus* (Linton).

Subfamily : DINURINAE

Genus DINURUS Looss 1907

***Dinurus barbatus* (Cohn, 1902) Looss, 1907**

*Scombroid host* : *Pelamys sarda* [= *Sarda sarda* (Bloch)]

*Locality* : Atlantic.

*Non-scombroid hosts* : *Coryphaena equisetis*, *C. hippurus* [Atlantic] ; *C. hippurus* [Secas Island, Panama].

*Remarks* : See Dawes (1946). It is likely that *Dinurus barbatus* along with *D. breviductus* Looss, 1907, and *D. longisinus* Looss, 1907 may be synonyms of *Distoma tornatum* Rudolphi, 1819 [= *Dinurus tornatum* (Rudolphi)]. Of these, *D. breviductus* was also described from *Pelamys sarda* (= *Sarda sarda*) and also from *Coryphaena hippurus* from the Atlantic (latter from Beaufort, N. Carolina, U.S.A.), and Yamaguti (1958) recognises this as a distinct species, a course which was also taken earlier by Manter (1947). Following Dawes (*op. cit.*), Ward (1954) recognises *Dinurus tornatus* (Rudolphi).

**Dinurus euthynni** Yamaguti, 1934

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific coast, Japan.

*Non-scombroid hosts* : None.

*Location* : Stomach.

**Dinurus scombri** Yamaguti, 1934

*Scombroid hosts* : *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn]

*Euthynnus alletteratus* [= *Euthynnus alletteratus* (Rafinesque)]

*Localities* : Toyama Bay, Japan ; Florida, U.S.A.

*Non-scombroid hosts* : None.

*Location* : Stomach.

Genus **ECTENURUS** Looss, 1907

(Syn. *Erilepturus* Woolcock, 1905)

**Ectenurus lepidus** Looss, 1907

*Scombroid host* : *Scomber colias* [= *Scomber japonicus colias* Gmelin].

*Locality* : Mediterranean.

*Non-scombroid hosts* : *Lichia amla*, *Atherina hepsetus*, *Caranx trachurus*, *Cepola rubescens*, *Lophius piscatorius*, *Maena vulgaris*, *Samaris alcede*, *Trachypteron taenia*, [Mediterranean]; *Trachurus trachurus* [Scotland and Black Sea—see Vlasenko, 1931]; *Helicolenus percoides*, *Trachurus novaezelandiae* [New Zealand—see Manter, 1954].

*Location* : Stomach.

Genus **LECITHOCLADIUM** Lühe, 1901**Lecithocladium excisum** (Rudolphi, 1819) Lühe, 1901

(Syn. *Distoma excisum* Rudolphi, 1819; *Distoma cristatum* Rudolphi, 1819; ? *Distomum crenatum* Molin, 1859)

*Scombroid hosts* : *Scomber scombrus* [= *Scomber scombrus* Linnaeus]

Spanish mackerel (see Dawes, 1946) [= *Scomber japonicus colias* Gmelin]

*Localities* : Mediterranean, Atlantic, Baltic, Pacific, Sea of Japan, and New Zealand.

*Non-scombroid hosts* : Immature flukes in *Trachurus trachurus*, *Box boops*, *Lophius piscatorius*, *Cepola rubescens*, etc.

*Remarks* : Dawes (1946) mentions *Lecithocladium excisiforme* Cohen (1903) as a synonym of *L. excisum* following Looss (1907). *Distomum crenatum* Molin (1859) is considered a doubtful synonym, and so also *Distomum gulosum* Linton (1901). The last said is a relatively larger form than *L. excisum* (6-8 mm. versus 10 mm. extended). I have followed Yamaguti (1958) in treating *L. excisiforme*, and *L. gulosum* (Linton) as separate species.

*Location* : Stomach.

**Lecithocladium excisiforme** Cohn, 1903

*Scombroid host* : *Scomber scomber* [= *Scomber scombrus* Linnaeus]

*Locality* : Mediterranean.

*Non-scombroid hosts* : *Stromateoides argenteus* [Inland Sea of Japan]

*Location* : Stomach.

**Lecithocladium gulosum** (Linton, 1901)

*Scombroid host* : *Pneumatophorus grex* [= *Scomber japonicus japonicus* Houttuyn]

*Scomber scombrus* [= *Scomber scomberus* Linnaeus].

*Locality* : Woods Hole, Massachusetts, U.S.A.

*Non-scombroid hosts* : *Poronotus triacanthus* [Woods Hole, Massachusetts, U.S.A.].

*Location* : Stomach.

*Remarks* : See Linton (1940) ; Dawes (1946).

**Lecithocladium angustiovum** Yamaguti, 1953

*Scombroid host* : *Scomber kanagurta* [= *Rastrelliger kanagurta* (Cuvier)]

*Locality* : Celebes (Macassar).

*Non-scombroid hosts* : None.

*Location* : Stomach.

**Lecithocladium parviovum** Yamaguti, 1953

*Scombroid host* : *Scomber kanagurta* [= *Rastrelliger kanagurta* (Cuvier)]

*Localities* : Celebes (Macassar).

*Non-scombroid hosts* : None.

*Location* : Stomach.

**Lecithocladium scombri** Yamaguti, 1953

*Scombroid hosts* : *Scomber kanagurta* [= *Rastrelliger kanagurta* (Cuvier)]

*Scomber microlepidotus* [= *Rastrelliger kanagurta* (Cuvier)]

*Locality* : Celebes (Macassar).

*Non-scombroid hosts* : None.

*Location* : Stomach.

## Subfamily : HYSTEROLECITHINAE

Genus *APONURUS* Looss, 1907**Aponurus tschugunowi** Issaïsch, 1928

(Syn. *A. tschugunovi* Vlasenko, 1931)

*Scombroid host* : *Sarda sarda* [= *Sarda sarda* (Bloch)]

*Locality* : Black sea ?

*Non-scombroid hosts* : Several species (see Yamaguti, 1958).



## Subfamily : STERRHURINAE

## Genus STERRHURUS Looss, 1907

(Syn. *Separogermiductus* Skrjalin and Guschanskaja, 1955 ; *Lecithochirium* Lühe, 1901, in part):

***Sterrhurus imocavus* Looss, 1907**

*Scombroid host* : *Thynnus* sp. [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus) ?]

*Locality* : Alexandria, Mediterranean.

*Non-scombroid hosts* : None.

***Sterrhurus monticelli* (Linton, 1898) Linton, 1910**

(Syn. *Distomum monticelli* Linton, 1898)

*Scombroid host* : *Gymnosarda alleterata* [= *Euthynnus alletteratus* (Rafinesque)]

*Locality* : Woods Hole, Massachusetts, U.S.A.

*Non-scombroid hosts* : *Cynoscion regalis*, *Paralichthys dentatus*, *Pomatomus saltatrix*, *Remora remora* Woods Hole ; For additional hosts from Bermuda ; Beaufort, North Carolina, and Tortugas, reference is invited to Linton (1940), Manter (1931, '34), and Pearse (1949).

*Location* : Intestine.

## Genus LECITHOCHIRIUM Lühe, 1901

(Syn. *Synaptobothrium* Linstow, 1904 ; *Plerurus* Looss, 1907)

Sprehn (1933) regards *Synaptobothrium* Linstow to be a synonym of *Lecithochirium* Lühe, which course is also followed by Yamaguti (1958). However, Dawes (1946) considers the two as generically distinct.

***Lecithochirium caudiporum* (Rudolphi, 1819)**

(Syn. *Distoma caudiporum* Rudolphi, 1819 ; *Synaptobothrium caudiporum* (Rudolphi) of Linstow 1904 and Dawes, 1946)

*Scombroid host* : *Sarda sarda* [= *Sarda sarda* (Bloch)]

*Scomber scombrus* Linnaeus

*Locality* : Black Sea.

*Non-scombroid hosts* : *Zeus faber*, *Pleuronectes platessa*, *Lophius piscatorius*, *Trigla lucerna*, *Gadus callarias*, *G. luscus*, *Scophthalmus rhombus*, *Conger conger* [Atlantic (Europe), Mediterranean.] Larvae in *Blennius pholis*, *Labrus bergylta*, *Crenilabrus melops* (See Dawes, 1946).

*Location* : Adults in stomach ; larvae encysted in viscera.

*Remarks* : See also Butzkaya (1952).

***Lecithochirium magnaporum* Manter, 1940**

*Scombroid host* : *Euthynnus alletteratus* [= *Euthynnus affinis yaito* Kishinouye ? or *E. a. meatus* Kishinouye ?]

*Locality* : Galapagos Islands (E. Pacific).

*Non-scombroid hosts* : *Paralabrax humeralis*, *Seriola dorsalis* [Galapagos Islands, E. Pacific].

**Lecithochirium microstomum** Chandler, 1935

*Scombroid host* : *Euthynnus alletteratus* [= *Euthynnus affinis yaito* Kishinouye? or *E.a. lineatus* Kishinouye?]

*Locality* : Galapagos Islands, E. Pacific.

*Non-scombroid hosts* : *Trichiurus lepturus* [Galveston Bay, Louisiana], *Galeichthys milberti* [Beaufort, North Carolina]; *Ancylopussetta dilecta*, *Promicrops itaiara*, *Tarpon atlanticus* [Florida]; *Calamus brachysomus*, *Caulolatilus* sp., *Paralabrax humeralis*, *Paranthias furcifer* [Galapagos Islands, E. Pacific].

**Lecithochirium texanum** (Chandler, 1941) Manter, 1947

*Scombroid hosts* : *Sarda sarda* [*Sarda sarda* (Bloch)]

*Euthynnus alletteratus* [= *Euthynnus alletteratus* (Rafinesque)]

*Localities* : Texas coast; and Florida, U.S.A.

*Non-scombroid hosts* : None.

## FAMILY : SYNCOELIIDAE

## Subfamily : SYNCOELIINAE

Genus SYNCOELIUM Looss, 1899

(Syn. *Capiatestes* Crowcroft, 1948)

**Syncoellium Katuwo** Yamaguti, 1938

*Scombroid host* : *Euthynnus pelamis* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific coast of Japan.

*Non-scombroid hosts* : None.

*Location* : Gills and Pharynx.

## FAMILY : DIDYMOZOIDAE

## Subfamily : DIDYMOZOINAE

Genus DIDYMOZOON Taschenberg, 1878, emend. Odhner, 1907

**Didymozoon auxis** Taschenberg, 1879

(Syn. *Didymozoum auxis* Taschenberg of Ishii, 1935)

*Scombroid host* : *Auxis rochei* [= *Auxis thazard* (Lacépède)]

*Auxis thazard* [= *Auxis thazard* (Lacépède)]

*Localities* : Naples, Mediterranean; Taizi, Japan.

*Non-scombroid hosts* : None.

*Location* : Gills and outer side of gill lamellae.

**Didymozoon fillicolle** Ishii, 1935

*Scombroid hosts* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific coast of Japan.

*Non-scombroid hosts* : *Seriola quinqueradiata* [Pacific coast of Japan]

*Location* : Gills.

**Didymozoon longicolle** Ishii, 1935

*Scombroid hosts* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn]

*Locality* : Pacific coast of Japan.

*Non-scombroid hosts* : None.

*Location* : Gills.

**Didymozoon minor** Yamaguti, 1934

*Scombroid host* : *Euthynnus pelamis* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific coast of Japan.

*Non-scombroid hosts* : None.

*Location* : Cysts in pairs on gills.

*Remarks* : Species name spelt as *D. minus* Yamaguti, 1958.

**Didymozoon pretiosum** Ariola, 1902

*Scombroid host* : *Thynnus vulgaris* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]

*Locality* : Naples, Mediterranean.

*Non-scombroid hosts* : None.

*Location* : Gills.

**Genus DIDYMOCYLINDRUS** Ishii, 1935**Didymocylindrus filiformis** Ishii, 1935

*Scombroid hosts* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Locality* : Japan, Pacific Ocean.

*Non-scombroid hosts* : None.

*Location* : Encysted on gills.

## Genus DIDYMOCYSTIS Ariola, 1902

**Didymocystis abdominalis** Yamaguti, 1938

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific coast of Japan.

*Non-scombroid host* : None.

*Location* : Body cavity.

**Didymocystis acanthocybii** Yamaguti, 1938

*Scombroid host* : *Acanthocybium sara* [= *Acanthocybium solandri* (Cuvier and Valenciennes)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Base of gill arch.

**Didymocystis alalongae** Yamaguti, 1938

*Scombroid host* : *Thynnus alalonga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Occurs in pairs in rounded somewhat flattened cysts about 15 mm. in diameter along gill arch.

**Didymocystis bilobata** Ishii, 1935

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Gills.

**Didymocystis coatesi** Nigrelli, 1939

*Scombroid host* : *Acanthocybium solandri* [= *Acanthocybium solandri* (Cuvier and Valenciennes)]

*Locality* : Florida.

*Non-scombroid hosts* : None.

*Remarks* : It is quite likely that this species may turn out to be a synonym of *D. acanthocybii* Yamaguti, (1938).

**Didymocystis crassa** Ishii, 1935

*Scombroid host* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Locality* : Pacific Ocean, Japans

*Non-scombroid hosts* : None.

**Didymocystis dissimilis** Yamaguti, 1938

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Oesophagus, stomach.

*Remarks* : Yamaguti (1934) reported this as *D. reniformis* Ariola, 1902, but in 1938, with more material described this as a new species, distinguishing it from *D. reniformis* in the unequal sizes of two individuals enclosed in a cyst.

**Didymocystis lanceolata** Guiart, 1938

*Scombroid host* : *Thynnus alalunga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]

*Locality* : Atlantic.

*Non-scombroid hosts* : None.

**Didymocystis macrorchis** Guiart, 1938

*Scombroid host* : *Thynnus alalunga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]

*Locality* : Atlantic.

*Non-scombroid hosts* : None.

**Didymocystis millaris** Yamaguti, 1938

*Scombroid host* : *Acanthocybium sara* [= *Acanthocybium solandri* (Cuvier and Valenciennes)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Base of gill arch.

**Didymocystis opercularis** Yamaguti, 1938

*Scombroid host* : *Thynnus alalunga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Encysted in pairs on fleshy lobe of inner surface of operculum.

**Didymocystis ovata** Ishii, 1935

*Scombroid hosts* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Mouth cavity.

**Didymocystis scomberomori** (G. A., and W. G. MacCallum, 1916)  
(Syn. *Koellikeria scomberomori* G. A., and W. G. MacCallum, 1916)

*Scombroid host* : *Scomberomorus maculatus* [= *Scomberomorus maculatus* (Mitchell)]

*Locality* : Atlantic.

*Non-scombroid hosts* : None.

*Location* : On gill lamellae.

**Didymocystis semiglobularis** Ishii, 1935

*Scombroid host* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Locality* : Pacific, Japan.

*Non-scombroid hosts* : None.

*Location* : On gills.

**Didymocystis simplex** Ishii, 1935

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : On gills.

**Didymocystis soleiformis** Ishii, 1935

*Scombroid hosts* : *Euthynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : *Seriola quinqueradiata* [Pacific Ocean, Japan]

*Location* : On gills.

**Didymocystis submentalis** Yamaguti, 1938

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Submental groove.

**Didymocystis thynni** (Taschenberg, 1879)

(Syn. *Didymozoon thynni* Taschenberg, 1879 ; *Didymocystis reniformis* Ariola, 1902)

*Scombroid host* : *Thynnus vulgaris* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]

*Locality* : Naples, Trieste, Genova, Nice—Mediterranean.

*Non-scombroid hosts* : None.

*Location* : Encysted on gills and inside of operculum.

**Didymocystis wedli** Ariola, 1902

(Syn. *Wedlia katsuwonicola* Okada, 1926 ; *Didymozoon* sp. Kobayashi, 1921 ; *Didymocystis kobayashii* Dollfus, 1926)

**Scombroid hosts :** *Thynnus vulgaris* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]  
*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

**Localities :** France, Italy, near Algiers (Mediterranean) ; Pacific Ocean and Toyama Bay, Japan.

**Non-scombroid hosts :** None.

**Location :** Gills and gill lamellae.

**Didymocystis xiphiados** (G. A. and W. G. MacCallum, 1916)

(Syn. *Koellikeria xiphiados* G. A., and W. G. MacCallum, 1916)

**Scombroid host :** *Xiphias gladius* [= *Xiphtas gladius* (Linnaeus)]

**Locality :** Woods Hole, Massachusetts, U.S.A.

**Non-scombroid hosts :** None.

**Location :** Gill cavity and muscles.

**Remarks :** See Linton (1940).

**Genus DIDYMOPROBLEMA** Ishii, 1935**Didymoproblema fusiforme** Ishii, 1935

**Scombroid hosts :** *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

**Locality :** Pacific Ocean, Japan.

**Non-scombroid hosts :** None.

**Genus LOBATOZOOM** Ishii, 1935**Lobatozoom multisacculatum** Ishii, 1935

**Scombroid hosts :** *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]

*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

**Locality :** Pacific Ocean, Japan.

**Non-scombroid hosts :** None.

**Location :** Gills.

**Genus PLATOCYSTIS** Yamaguti, 1938**Platocystis alalongae** Yamaguti, 1938

**Scombroid host :** *Thynnus alalonga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]

**Locality :** Pacific Ocean, Japan.

**Non-scombroid hosts :** None.

**Location :** Encysted in pairs in skin.

## Subfamily : ATALOSTROPHIINAE

Genus ATALOSTROPHION G. A. MacCallum, 1915

**Atalostrophion sardae** MacCallum, 1915*Scombroid host* : *Sarda sarda* [= *Sarda sarda* (Bloch)]*Locality* : Woods Hole, Massachusetts, U.S.A.*Non-scombroid hosts* : None.*Location* : Under mucous membrane of branchial cavity.

*Remarks* : Yamaguti (1958) has given reasons for considering *Atalosparganum* Ishii (1935) originally proposed as the type subgenus of *Atalostrophion* to be a synonym of the latter. Ishii described *Atalostrophium* (*Atalosparganum*) sp., from the branchial cavity of *Katsuwonus vagans* [= *Katsuwonus pelamis* (Linnaeus)], but on account of certain discrepancies in the original description, Yamaguti (1958) provisionally refers this form to the genus *Metanematobothrium* Yamaguti, 1938 (Subfamily Nematobothriinae).

## Subfamily : COLOCYNTOTREMATINAE

Genus COLOCYNTOTREMA Yamaguti, 1951

**Colocyntotrema auxis** Yamaguti, 1951*Scombroid host* : *Auxis thazard* [= *Auxis thazard* (Lacépède)]*Locality* : Taizi, Wakayama Prefecture, Japan.*Non-scombroid hosts* : None.*Location* : Pyloric caeca.

Genus PHACELOTREMA Yamaguti, 1951

**Phacelotrema claviforme** Yamaguti, 1951*Scombroid host* : *Auxis thazard* [= *Auxis thazard* (Lacépède)]*Locality* : Taizi, Wakayama Prefecture, Japan.*Non-scombroid hosts* : None.*Location* : Pyloric caeca.

## Subfamily : GLOMERITREMATINAE

Genus GLOMERITREMA Yamaguti, 1942

**Glomeritrema subcuticola** Yamaguti, 1942*Scombroid host* : *Tetrapturus mitsukurina* [= *Tetrapturus audax* (Phillipi)]*Locality* : Naha, Okinawa, Pacific.*Non-scombroid host* : None.*Location* : Subcutaneous tissue.



**Subfamily : KOELLIKERNAE**Genus **KOELLIKERIA** Cobbold, 1860(Syn. *Wedlia* Cobbold, 1860 ; *Didymostoma* Ariola, 1902)**Koellikeria bipartita** (Wedl, 1855)Syn. *Didymostoma bipartitum* (Wedl, 1855 ; Ariola, 1902)*Scombroid hosts* : *Thynnus vulgaris* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]*Thynnus secundo-dorsalis* [= *Thunnus* (T.) *thynnus thynnus* (Linnaeus)]*Localities* : Trieste, Nice, Naples [Mediterranean] ; Atlantic coast, U.S.A.*Non-scombroid hosts* : None.*Location* : Gills, gill arches, skin of head.**Koellikeria globosa** Ishii*Scombroid hosts* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]*Locality* : Tokyo, Japan.*Non-scombroid host* : *Seriola quinqueradiata* [Tokyo, Japan].**Koellikeria orientalis** (Yamaguti, 1934)(Syn. *Wedlia orientalis* Yamaguti, 1934)*Scombroid hosts* : *Germo macropterus* [= *T.(N.) albacares macropterus* (Temminck and Schlegel)]*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]*Thynnus thynnus* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]*Localities* : Kuki, Japan ; Kuki and Inland Sea, Japan ; Toyama Bay, Japan.*Non-scombroid host* : None.*Location* : Small and large intestine, anus, oesophagus, stomach, gills.**Koellikeria reniformis** Ishii, 1935*Scombroid hosts* : *Thynnus orientalis* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]*Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)].*Locality* : Tokyo, Japan.*Non-scombroid hosts* : *Seriola quinqueradiata* (Tokyo, Japan).*Location* : Gills.Genus **COELIOTREMA** Yamaguti, 1938**Coeliotrema thynni** Yamaguti, 1938*Scombroid host* : *Thynnus thynnus* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]*Locality* : Suruga Bay, Japan.*Non-scombroid hosts* : None.*Location* : Mesentery.

## Subfamily : NEMATOBOTHRINA

Genus NEMATOBOTHRUM van Beneden, 1858

**Nematobothrium faciale** (Baylis, 1938)(Syn. *Didymozoon faciale*, Baylis, 1938)*Scombroid host* : *Scomber scombrus* [= *Scomber scombrus* (Linnaeus)]*Locality* : English Channel.*Non-scombroid hosts* : None.*Location* : Cysts beneath outer skin of head, behind eye.**Nematobothrium filiforme** Yamaguti, 1934(Syn. *Nematobothrium sabae* Ishii, 1935)*Scombroid host* : *Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn]*Locality* : Toyama Bay, and Pacific, Japan.*Non-scombroid hosts* : None.*Location* : Encysted in pairs on gills.**Nematobothrium latum** Guiart, 1938*Scombroid host* : *Thynnus alalunga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]*Locality* : Atlantic.*Non-scombroid hosts* : None.*Location* : Encysted on stomachal peritoneum.**Nematobothrium pelamydis** (Taschenberg, 1879)(Syn. *Didymozoon pelamydis* Taschenberg, 1879)*Scombroid host* : *Pelamys sarda* [= *Sarda sarda* (Bloch)]*Locality* : Naples, Genova, Portoferraio [Mediterranean].*Non-scombroid hosts* : None.*Location* : Between gill lamellae.**Nematobothrium scombri** (Taschenberg, 1879)(Syn. *Didymozoon scombri* Taschenberg, (1879)*Scombroid hosts* : *Scomber colias* [= *Scomber japonicus colias* Gmelin] ;*Scomber scomber* [= *Scomber scombrus* Linnaeus] ;*Scomber japonicus* [= *Scomber japonicus japonicus* Houttuyn].*Localities* : Naples, Genova ; Venice, Trieste, Krestenberg, Ireland, Pacific Ocean, Japan.*Non-scombroid hosts* : None.*Location* : Cysts on roof of buccal cavity between pharyngo-branchial elements ; external surface of basibranchials ; parts of gill arch and inner surface of operculum.

## Genus METANEMATOBOTHRIUM Yamaguti, 1938

**Metanematobothrium guernei** (Moniez, 1891)

(Syn. *Nematobothrium* (*Benedenozoum*) *guernei* Moniez of Ishii, 1935)

*Scombroid host* : *Thynnus alalunga* [= *Thunnus* (T.) *alalunga* (Bonnaterre)]

*Locality* : Atlantic coast of France; Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Gills, submaxillary muscles, intestine.

## Genus UNITUBULOTESTES Yamaguti, 1952

**Unitubulotestes sardae** (G.A., and W. G. MacCallum, 1916)

(Syn. *Nematobothrium sardae* G.A., and W. G. MacCallum, 1916)

*Scombroid host* : *Sarda sarda* [= *Sarda sarda* (Bloch)]

*Locality* : Woods Hole, Massachusetts, U.S.A. (N.W. Atlantic) ; Black Sea.

*Non-scombroid hosts* : None.

*Location* : Pharyngo-branchial region or gills.

*Remarks* : See Grabda and Siwak-Grabda (1948) for redescription of species from same host from Black Sea.

## Subfamily : NEODILOTREMATINAE

## Genus NEODILOTREMA Yamaguti, 1938

(Syn. *Diplootrema* Yamaguti, 1938 *nec* Spencer, 1900)

**Neodiplootrema pelamydes** (Yamaguti, 1938)

(Syn. *Diplootrema pelamydes* Yamaguti, 1938)

*Scombroid host* : *Euthynnus pelamys* [= *Katsuwonus pelamis* (Linnaeus)]

*Locality* : Pacific Ocean, Japan.

*Non-scombroid hosts* : None.

*Location* : Fifth gill arch.

## Subfamily : OPEPHEROTREMATINAE

## Genus OPEPHEROTREMA Yamaguti, 1951

**Opepherotrema planum** Yamaguti, 1951

*Scombroid host* : *Auxis thazard* [= *Auxis thazard* (Lacépède)]

*Locality* : Taizi, Wakayama Prefecture, Japan.

*Non-scombroid hosts* : None.

*Location* : Pyloric caeca.

## HOST-PARASITE LIST NO. II

(List of names of scombroid hosts and their trematode parasites. Genera are alphabetically arranged. (?) indicates doubtful record of parasite species from host.)

HOST	PARASITE
<i>Acanthocybium solandri</i> (Cuvier and Valenciennes) .....	<i>Didymocystis acanthocybii</i> Yamaguti <i>Didymocystis coatesi</i> Nigrelli <i>Didymocystis miliaris</i> Yamaguti <i>Hirudinella beebei</i> Chandler ? <i>Hirudinella ventricosa</i> (Pallas)
<i>Auxis thazard</i> (Lacépède) .....	<i>Colocytotrema auxis</i> Yamaguti <i>Didymozoon auxis</i> Taschenberg <i>Opepherotrema planum</i> Yamaguti <i>Phacelotrema claviforme</i> Yamaguti <i>Rhipidocotyle capitata</i> (Linton) <i>Tergestia laticollis</i> (Rudolphi)
<i>Euthynnus alletteratus</i> (Rafinesque) .....	<i>Dinurus scombri</i> Yamaguti <i>Lecithochirium texanum</i> (Chandler) <i>Rhipidocotyle capitatum</i> (Linton) <i>Rhipidocotyle nagaty</i> Manter <i>Sterrhurus monticelli</i> (Linton) <i>Tergestia laticollis</i> (Rudolphi)
<i>Euthynnus affinis affinis</i> (Cantor) .....	<i>Rhipidocotyle septapapillata</i> Krull
<i>Euthynnus affinis lineatus</i> Kishinouye .....	? <i>Lecithochirum magnaporum</i> Manter ? <i>Lecithochirum microstomum</i> Chandler
<i>Euthynnus affinis yaito</i> Kishinouye .....	? <i>Lecithochirum magnaporum</i> Manter ? <i>Lecithochirum microstomum</i> Chandler
<i>Istiophorus gladius</i> (Broussonnet) .....	<i>Hemiurus sardiniae</i> (Yamaguti)
<i>Katsuwonus pelamis</i> (Linnaeus) .....	<i>Atalostrophion sardae</i> MacCallum <i>Atalostrophium</i> ( <i>Atalospar garum</i> ) sp. Ishii (1935) <i>Didymocylindrus filiformis</i> Ishii <i>Didymocystis abdominalis</i> Yamaguti <i>Didymocystis bilobata</i> Ishii <i>Didymocystis dissimilis</i> Yamaguti <i>Didymocystis ovata</i> Ishii <i>Didymocystis simplex</i> Ishii <i>Didymocystis soleiformis</i> Ishii <i>Didymocystis submentalis</i> Yamaguti <i>Didymocystis wedli</i> Ariola <i>Didymoprolema fusiformes</i> Ishii <i>Didymozoon filicollis</i> Ishii <i>Didymozoon longicollis</i> Ishii <i>Didymozoon minor</i> Yamaguti <i>Dinurus euthynni</i> Yamaguti <i>Hirudinella marina</i> (Garsin) <i>Koellikeria globosa</i> Ishii <i>Koellikeria orientalis</i> (Yamaguti) <i>Koellikeria reniformis</i> Ishii <i>Lobatozoum multisacculatum</i> Ishii <i>Neodiplostrema pelamydes</i> (Yamaguti) <i>Syncocelium katuwo</i> Yamaguti

<i>Rastrelliger kanagurta</i> (Cuvier).....	<i>Decemtestis biacetabulatus</i> Srivastava <i>Helicometrina orientalis</i> Srivastava <i>Lecithocladium angustiovum</i> Yamaguti <i>Lecithocladium parviovum</i> Yamaguti <i>Lecithocladium scombri</i> Yamaguti <i>Opechona scombri</i> Yamaguti
<i>Sarda orientalis</i> (Temminck and Schlegel) ..	<i>Bucephalopsis cybii</i> Park
<i>Sarda sarda</i> (Bloch).....	<i>Aponurus tschugunowi</i> Issaitsch <i>Atalostrophion sardae</i> MacCallum <i>Bucephalopsis arcuata</i> (Linton) <i>Dinurus barbatus</i> (Cohn) <i>Hirudinella clavata</i> (Menzies) <i>Lecithochirum caudiporum</i> (Rudolphi) <i>Lecithochirum texanum</i> (Chandler) <i>Nematobothrium pelamydis</i> (Taschenberg) <i>Opecoelides vitellosus</i> (Linton) <i>Rhipidocotyle angusticollis</i> Chandler ? <i>Tormopsolus orientalis</i> Yamaguti <i>Unitubulotestes sardae</i> (MacCallum and Mac- Callum)
<i>Scomber japonicus japonicus</i> Houttuyn.....	<i>Didymozoon longicolle</i> Ishii <i>Dinurus scombri</i> Yamaguti <i>Lecithocladium gulosum</i> (Linton) <i>Lepocreadium retrusum</i> Linton <i>Nematobothrium filiforme</i> Yamaguti <i>Nematobothrium scombri</i> (Taschenberg) <i>Opechona olssoni</i> (Yamaguti) <i>Opechona orientalis</i> (Layman) <i>Opechona scombri</i> Yamaguti <i>Tergestia acanthocephala</i> (Stossich) <i>Tergestia laticollis</i> (Rudolphi)
<i>Scomber japonicus colias</i> Gmelin .....	? <i>Aphallus tubarium</i> (Rudolphi, 1819) <i>Ectenurus lepidus</i> Looss <i>Lecithocladium excisum</i> (Rudolphi) <i>Nematobothrium scombri</i> (Taschenberg) <i>Opechona bacillaris</i> (Molin)
<i>Scomber scombrus</i> Linnaeus.....	<i>Hemiurus appendiculatus</i> (Rudolphi) <i>Lecithochirum caudiporum</i> (Rudolphi) <i>Lecithocladium excisum</i> (Rudolphi) <i>Lecithocladium excisiforme</i> Cohn <i>Lecithocladium gulosum</i> (Linton) <i>Opechona bacillaris</i> (Molin) <i>Opechona orientalis</i> (Layman) <i>Opecoelides vitellosus</i> (Linton) <i>Nematobothrium faciale</i> (Baylis) <i>Nematobothrium scombri</i> (Taschenberg) <i>Podocotyle simplex</i> (Rudolphi) <i>Tergestia acanthocephala</i> (Stossich) <i>Tergestia laticollis</i> (Rudolphi)
<i>Scomber</i> sp.....	<i>Bathycotyle branchialis</i> Darr

<i>Scomberomorus guttatus guttatus</i> (Bloch and Schneider).....	<i>Bucephalus jaggannathi</i> Verma
<i>Scomberomorus guttatus koreanus</i> (Kishinouye)	<i>Bucephalopsis cybii</i> Park
<i>Scomberomorus maculatus</i> (Mitchill).....	<i>Bucephalus heterotentaculatus</i> Bravo-Hollis & Sogandares-Bernal
	<i>Didymocystis scomberomori</i> (MacCallum and MacCallum)
<i>Scomberomorus nipponius</i> (Cuvier and Valenciennes)	<i>Rhipidocotyle baculum</i> (Linton)
<i>Scomberomorus regalis</i> (Bloch).....	<i>Rhipidocotyle pentagonum</i> (Ozaki)
	<i>Bucephalopsis arcuata</i> (Linton)
<i>Scomberomorus</i> sp.....	<i>Rhipidocotyle adbaculum</i> Manter
<i>Tetrapturus audax</i> Philippsi.....	<i>Rhipidocotyle baculum</i> (Linton)
<i>Thunnus (Thunnus) alalunga</i> (Bonnaterre)..	<i>Bucephalopsis cybii</i> Park
	<i>Glomeritema subcuticola</i> Yamaguti
<i>Thunnus (Neothunnus) albacares macropterus</i> (Tem. & Sch.)	<i>Didymocystis alalongae</i> Yamaguti
<i>Thunnus (Thunnus) thynnus orientalis</i> (Temminck and Schlegel) .....	<i>Didymocystis lanceolata</i> Guiart
	<i>Didymocystis macrorchis</i> Guiart
	<i>Didymocystis opercularis</i> Yamaguti
	<i>Hirudinella spinulosa</i> Yamaguti
	<i>Hirudinella poirieri</i> (Moniez)
	<i>Metanematobothrium guernei</i> (Moniez)
	<i>Nematobothrium latum</i> Guiart
	<i>Platocystis alalongae</i> Yamaguti
	<i>Koellikeria orientalis</i> (Yamaguti)
	<i>Bucephalopsis sibi</i> Yamaguti
	<i>Coeliotrema thynni</i> Yamaguti
	<i>Didymocylindrus filiformis</i> Ishii
	<i>Didymocystis crassa</i> Ishii
	<i>Didymocystis ovata</i> Ishii
	<i>Didymocystis semiglobularis</i> Ishii
	<i>Didymocystis soleiformis</i> Ishii
	<i>Didymoprolema fisiformis</i> Ishii
	<i>Didymozoon filicollis</i> Ishii
	<i>Didymozoon longicollis</i> Ishii
	<i>Koellikeria globosa</i> Ishii
	<i>Koellikeria orientalis</i> (Yamaguti)
	<i>Koellikeria reniformis</i> Ishii
<i>Thunnus (Thunnus) thynnus thynnus</i> (Linnaeus).....	<i>Didymocystis thynni</i> (Taschenberg)
	<i>Didymocystis wedli</i> Ariola
	<i>Didymozoon pretiosum</i> Ariola
	<i>Hirudinella clavata</i> (Menzies)
	<i>Koellikeria bipartita</i> (Wedl)
	<i>Sterrhurus imocavus</i> Looss
<i>Xiphias gladius</i> Linnaeus.....	<i>Didymocystis xiphoides</i> (MacCallum and MacCallum)
	<i>Hirudinella clavata</i> (Menzies)
	<i>Hirudinella ventricosa</i> (Pallas)

## CLASS : CESTODA

## Subclass : EUCESTODA

## Order : PSEUDOPHYLLIDAE

Genus BOTHRIOCEPHALUS Rudolphi, 1808

(Syn. *Dibothrium* Diesing, 1850)***Bothriocephalus manubriiformis* (Linton, 1889)**

[Syn. *Dibothrium manubriiformis* Linton, 1889 ; *Acanthobothrium laciniatum* Linton, 1898 ; *Bothriocephalus histiophorus* Shipley 1909 ; *B. plicatum* (Rudolphi) Shipley 1900]

- Scombroid hosts* :
1. *Istiophorus nigricans* [= *Istiophorus gladius* (Broussonnet)]
  2. *Tetrapterus imperator* [= *Tetrapturus albidus* Poey]
  3. *Tetrapturus albidus* [= -do- ]
  4. *Histiophorus gladius* [= *Istiophorus gladius* (Broussonnet)]
  5. *Histiophorus* sp. [= -do- ]
  6. *Histiophorus grayei* [= -do- ]

*Localities* : 1-4 from Woods Hole, New England Coast, N.W. Atlantic ; 5 from Indian and Pacific Oceans ; and 6 from Pacific coast of Mexico.

*Non-scombroid hosts* : *Tarpon atlanticus*, *Prionace glauca*, *Carcharhinus milberti*, *Carcharhinus obscurus*, *Isurus dekay*, *Raja eglanteria*, *Sphyrna zygaena* [Woods Hole, New England Coast, N.W. Atlantic].

*Location* : Spiral valve in elasmobranchs ; intestine in teleosts.

***Bothriocephalus scorpii* (Mueller, 1776)**

[Syn. *Taenia scorpii* Mueller, 1776 ; *Vermis multiembris rhombi* Leeuwenhoek 1722 ; *Bothriocephalus punctatus* Rudolphi 1810 ; *Dibothrium punctatus* Diesing, 1850 ; and *Bothriocephalus bipunctatus* (Zeder, 1800) Lühe, 1899]

*Scombroid host* : *Scomber scombrus* Linnaeus

*Locality* : Woods Hole, New England Coast, N.W. Atlantic.

*Non-scombroid hosts* : *Decapterus punctatus*, *Hemitripterus americanus*, *Hippoglossus hippoglossus*, *Limanda ferruginea*, *Lophopsetta maculata*, *Myxocephalus aeneus*, *M. octodecimspinosus*, *Palinurichthys perciformis*, *Paralichthys dentatus*, *P. oblongus*, *Pseudopleuronectes americanus*, *Trachurops crumenophthalmus*, *Urophycis chuss*, *Arnoglossus laterna*, *A. pegosa*, *Bothus podas*, *Hippoglossus platessoides*, *Lepidorhombus boscii* [same as *Pleuronectes boscius* from which Rudolphi (1819) described *B. punctatus*] *Monochirus hispidus*, *Phrynorhombus norvegicus*, *Platichthys flesus*, *Pleuronectes platessa*, *Pleuronectes* sp., *Scophthalmus aquosus*, *S. maximus*, *S. maeoticus*, *S. rhombus*, *Cottus scorpei*, and in species of the following genera : *Anguilla*, *Clupea*, *Dactylopterus*, *Enophris*, *Eurytemora*, *Gadus*, *Gobius*, *Hexagrammos*, *Labrus*, *Lateolabrax*, *Leptocottus*, *Lophius*, *Menticirrhus*, *Merluccius*, *Mullus*, *Nerophis*, *Oligoplites*, *Pollachius*, *Pomolobus*, *Poronotus*, *Raja*, *Rhamdia*, *Scorpaena*, *Seriola* and in *Syphonostoma typhle* [Atlantic, Mediterranean, Pacific, N. Siberia, White Sea, and Black Sea].

*Location* : Pleurocerca in stomach and intestine of teleostean hosts.

*Remarks* : See also Sumner *et al.* (1913).

## FAMILY : TRIAENOPHORIDAE

Genus FISTULICOLA Lühe, 1899

**Fistulicola plicatus** (Rudolphi, 1819), Luhe, 1899

[Syn. ? *Echinorhynchus xiphae* Gmelin, 1790 ; *Bothriocephalus plicatus* Rudolphi, 1819 ; *Bothriocephalus xiphae* (Gmelin) Goode, 1883]

*Scombroid host* : *Xiphias gladius* Linnaeus

*Locality* : Woods Hole, New England Coast, N.W. Atlantic, European.

*Non-scombroid hosts* : None.

*Location* : Walls of intestine and rectum.

*Remarks* : Refer also Linton (1901), and Cooper (1918). Dollfus (1935) regarded this species and *Bothriocephalus truncatus* Leuckart, 1819, as conspecific with *F. xiphae* (Gmelin, 1790).

## Order : TETRAPHYLLIDEA

Genus SCOLEX Rudolphi, 1919

**Scolex pleuronectis** Mueller, 1788

(Syn. *Scolex polymorphus* Rudolphi, 1819 ; *Scolex delphinus* Stossich, 1898)

*Scombroid hosts* : *Sarda sarda* (Bloch)

*Scomber scombrus* Linnaeus

*Xiphias gladius* Linnaeus

*Localities* : Woods Hole, Massachusetts, N.W. Atlantic.

*Non-scombroid hosts* : *Anchovia argyrophanus*, *A. brownii*, *Anguilla* sp., *Brevoortia tyrannus*, *Centropristis striatus*, *Clupea harengus*, *Cynoscion regalis*, *Decapterus macarellus*, *D. punctatus*, *Etrumeus teres*, *Fundulus heteroclitus*, *Hippoglossus hippoglossus*, *Lagocephalus laevigatus*, *Leptocephalus conger*, *Limanda ferruginea*, *Lophius piscatorius*, *Lopholatilus chamaeleonichthys*, *Melanogrammus aeglefinus*, *Menticirrhus saxatilis*, *Merluccius bilinearis*, *Microgadus tomcod*, *Opsanus tau*, *Palinurichthys perciformis*, *Paralichthys dentatus*, *P. oblongus*, *Pomatomus saltatrix*, *Pomolobus mediocris*, *P. pseudoharengus*, *Poronotus triacanthus*, *Raja laevis*, *Spheroides maculatus*, *Stenotomus chrysops*, *Tautoga onitis*, *Trichiurus lepturus*, *Tylosurus marinus*, *Urophycis chuss* [Woods Hole, New England Coast, N.W. Atlantic] ; *Sardinella longiceps* [Indian Ocean and tidal rivers of India] ; *Arnoglossus grohmanni*, *A. laterna*, *Arnoglossus* sp., *Bothus podas*, *Eucitharus linguatula*, *Hippoglossoides platessoides*, *Limanda limanda*, *Pleuronectes platessa*, *Pseudopleuronectes americanus*, *P. herzensteini*, *Scophthalmus maeoticus*, *S. maximus*, *S. rhombus* and *Solea solea* [Atlantic and Mediterranean].

*Location* : Larvae free in intestine.

*Remarks* : See also Sumner *et al.* (1913), Southwell (1925, 1930), Ronald (1959) and Wardle and McLeod (1952).

## FAMILY : PHYLLOBOTHRIIDAE

Genus PELICHNIBOTHRIUM Monticelli, 1889

**Pelichnibothrium speciosum** Monticelli, 1889

[Syn. *P. caudatum* (Zschokke and Heitz, 1914) ; *Phyllobothrium salmonis* Fujita, 1922]

*Scombroid host* : *Thynnus thynnus* [= *Thunnus* (T.) *thynnus orientalis* (Temminck and Schlegel)]



*Locality* : Pacific coast of Japan.

*Non-scombroid hosts* : *Aspidosaurus ferox* [Madeira, E. Atlantic] ; *Prionace glauca*, *Lampris regis* [Pacific coast of Japan].

*Location* : Adults in elasmobranchs, tailed larvae in teleosts.

*Remarks* : Also refer Southwell (1925), and Wardle and McLeod (1952).

#### Genus PHYLLOBOTHRIUM Beneden, 1849

[Syn. *Crossobothrium* Linton, 1889 ; *Anthocephalum* Linton, 1890 ; *Calyptobothrium* Monticelli 1893 ; *Bilocularia* Obersteiner, 1914]

#### *Phyllobothrium loliginis* (Leidy, 1887) Linton, 1897

*Scombroid host* : *Xiphias gladius* Linnaeus

*Locality* : Woods Hole, New England Coast, N.W. Atlantic.

*Non-scombroid hosts* : *Hemitripterus americanus*, *Mustelus canis*, *Paralichthys dentatus*, *P. oblongus*, *Raja laevis*, *R. ocellata*, *Spheroides maculatus*, *Squalus acanthias*, *Urophycis chuss*, *U. tenuis* [Woods Hole, Massachusetts, New England Coast, N.W. Atlantic].

*Location* : Adults in the stomach of squids *Ommastrephes illecebrosus* [Massachusetts coast, U.S.A.], and *O. sagittatus* [Mediterranean]. Immature specimens in stomachs of fish hosts.

*Remarks* : See also Sumner *et al.* (1913).

#### Order : TRYPANORHYNCHA

#### FAMILY : TENTACULARIIDAE

#### Genus TENTACULARIA Bosc, 1797

#### *Tentacularia coryphaena* Bosc, 1797

[Syn. *Stenobothrium macrobothrium* [Rudolphi, 1810] Diesing ; *Tentacularia boscii* Siebold, 1850]

*Scombroid hosts* : Larvae in

*Xiphias gladius* Linnaeus ;

*Pelamys* [= *Sarda sarda* (Bloch)] ;

*Thynnus* [= *Thunnus* sp.] ;

*Scomber* [= *Scomber* sp.]

*Locality* : Atlantic.

*Non-scombroid hosts* : *Coryphaena hippurus* ; *Lophius* sp. ; *Pleuronectes* sp., *Hippoglossus hippoglossus*, *Hippoglossus* sp., *Paralichthys dentatus* [Atlantic] ; Adults in *Prionace glauca*, *Scoliodon walbeehmi* [Pacific coast of Japan].

*Remarks* : See Winninger (1929, '30) for list of a variety of hosts for *Stenobothrium macrobothrium* Diesing ; Wardle and McLeod (1952) for discussion.

#### *Tentacularia bicolor* (Bartels, in Nordmann, 1832)

*Scombroid hosts* : 1. *Scomber pelamys* [= ? *Katsuwonus pelamis* (Linnaeus)]

2. *Sarda sarda* [= *Sarda sarda* (Bloch)]

3. *Xiphias gladius* Linnaeus

**Localities :** 1. Unknown, probably Atlantic !; 2. and 3. Woods Hole, New England Coast, N.W. Atlantic.

**Non-scombroid hosts :** *Galeocerdo tigrinus*, *Carcharhinus obscurus*, *Coryphaena hippurus*, *Paralichthys dentatus* [Woods Hole, New England coast, N.W. Atlantic] ; *Coryphaena hippurus*, *C. equistis*, and *Halichelys atra* [localities unknown].

**Location :** Cysts and scolices found in all above mentioned hosts in peritoneum, mesentery, stomach and alimentary canal. - In scombroids in peritoneum and mesentery. Adult taken in *Carcharhinus obscurus*.

#### Genus NYBELINIA Poche, 1926

(Syn. *Acoelorhynchus* Poche, 1926 ; *Aspidorhynchus* Molin, 1858-preoccupied ; *Congerina* Guiart, 1935 ; *Rufferia* Guiart, 1927 ; *Stenobothrium* Diesing of Pintner, 1913)

Yamaguti (1959) subdivides the genus into two subgenera, *Nybelinia* s.str., and *Syngenes*, and we are concerned here with species referable to the former.

#### *Nybelinia* (*Nybelinia*) *lingualis* (Cuvier, 1817)

**Scombroid hosts :** *Xiphias gladius* Linnaeus

**Locality :** Atlantic.

**Non-scombroid hosts :** *Solea vulgaris*, *Pleuronectes platessa*, *Pleuronectes* gen?, and sp?, *Scophthalmus maximus*, *S. rhombus*, *Solea solea*, *Lophius piscatorius*, *Trigla gurnardus*, *Oxyrhina spallanzanii*, *Galeus canis*, *Raja* sp., *Acanthias vulgaris*, *Squatina angelus*, *Scyllium stellare* [Atlantic]. For additional hosts see Joyeux and Bear (1936).

#### *Nybelinia* (*Nybelinia*) *bisulcata* (Linton, 1889)

(Syn. *Rhynchobothrium bisulcatus* Linton, 1889)

**Scombroid hosts :** *Xiphias gladius* Linnaeus

*Scomber scomber* [= *Scomber scombrus* Linnaeus]

**Localities :** Woods Hole, North West Atlantic.

**Non-scombroid hosts :** *Carcharhinus obscurus*, *C. milberti*, *Galeocerdo articus*, *Aqualus acanthias*, *Cestracion zygaena*, *Paralichthys albigutta*, *P. dentatus*, *P. oblongus*, *Pseudopleuronectes americanus*, *Scophthalmus aquosus*, *Symphurus*, *plagusia*, *Cynoscion regalis*, *Decapterus macarelus*, *Lophius piscatorius*, *Lopholatilus chamaeleonticeps*, *Pomatomus saltatrix*, *Prionotus triacanthus*, *Prionotus carolinus*, *P. strigatus*, *Seriola zonata*, *Spheroides maculatus*, *Stenostomus chrysops*, *Tetronarce occidentalis*, *Urophycis chuss* [North West Atlantic].

**Location :** Cysts and scolices in viscera of hosts mentioned above ; adults abundant in pylorus and intestine of *Carcharhinus obscurus*.

**Remarks :** See Sumner et al. (1913), and Ronald (1959) for host records. Refer also Dollfus (1942) for detailed studies on species of the genus *Nybelinia*. Yamaguti (1959) mentions that the species has also been noted to occur in the Cephalopod *Sepiella maindorini* in Japanese waters.

#### *Nybelinia* (*Nybelinia*) *lamontae* Nigrelli, 1938

**Scombroid host :** *Xiphias gladius* Linnaeus

**Locality :** Nova Scotia, N.W. Atlantic.

**Non-scombroid hosts :** None.

## FAMILY : DASYRHYNCHIDAE

Genus CALLITETRARHYNCHUS Pintner, 1931

(Syn. *Acanthocephalus* Rudolphi, 1819, in part ; *Lintoniella* Yamaguti nec Woodland, 1927)*Callitetrarhynchus gracilis* (Rudolphi, 1819)(Syn. *Anthocephalus gracile* Rudolphi, 1819 ; *Rhynchobothrium speciosum* Linton, 1897 ; *Lintoniella speciosa* Yamaguti, 1934 ; *Tentacularia lepida* Chandler, 1935 ; *Callitetrarhynchus gracillimum* Pintner, 1931, and *Tentacularia pseudodera* Shuler, 1938)Scombroid hosts : *Scomber rocheus* [= *Auxis thazard* (Lacépède)]*Scomber scombrus* Linnaeus*Scomberomorus maculatus* [= *Scomberomorus maculatus* (Mitchill)]*Thynnus* sp. [= *Thunnus* sp.]

Localities : Mediterranean, Atlantic.

Non-scombroid hosts : *Carcharhinus obscurus*, *Dasyatis centrura*, *Hypoprion brevirostris*, *Alutera schoepfi*, *Paralichthys dentatus*, *P. olivaceus*, *Galeichthys felis*, *Chaetodipterus faber*, *Cynoscion regalis*, *Lophius piscatorius*, *Pomatomus saltatrix*, *Remora remora*, *Roccus lineatus*, *Stenotomus chrysops*, *Trichiurus lepturus*, *Tylosurus acus*, *Brama* sp., *Sparus* sp., *Muraenesox* sp., *Scomberoides* sp., *Seriola* sp., *Caranx* sp., *Ceratacanthus* sp. [North Atlantic, Mediterranean and Pacific].

Location : In scombroids and other teleosts larvae encysted in viscera. Adults in elasmobranchs (e.g. *Carcharhinus obscurus*).

Remarks : Shuler (1938) records adults of this species as *Tentacularia pseudodera* from *Hypoprion brevirostris*. For host records see Chandler (1935).

## FAMILY : GYMNORHYNCHIDAE

Genus GYMNORHYNCHUS Rudolphi, 1819

Two subgenera, *Gymnorhynchus* s.str., and *Molicola* Dollfus, are recognised by Dollfus (1935).*Gymnorhynchus* (*Gymnorhynchus*) *gigas* Cuvier, 1817(Syn. *Gymnorhynchus gigas* Southwell, 1930 in part)Scombroid host : *Xiphias gladius* Linnaeus

Locality : North East Atlantic and Mediterranean.

Non-scombroid hosts : *Brama rayi* ; *Paralichthys dentatus* (see Wardle and McLeod, 1952 ; Ronald, 1959).

Location : Pleurocercus in muscles.

Remarks : According to Wardle and McLeod (1952) this species is rarely found in the swordfish *Xiphias gladius*, but not from American waters.

*Gymnorhynchus* (*Molicola*) *uncinatus* (Linton, 1924)

[Syn. *Rhynchobothrium uncinatus* Linton, 1924 ; *Floriceps uncinatus* (Linton) Yamaguti, 1952 ; *Molicola uncinatus* (Linton) Yamaguti, 1959 ; ? *Molicola horridius* (Goodsir, 1841), Dollfus, 1935]

Scombroid host : *Xiphias gladius* Linnaeus

Locality : Woods Hole, Massachusetts, U.S.A.

Non-scombroid hosts : *Mola mola* [Atlantic] ; *Vulpecula marina* [North Western Atlantic and Pacific] ; ? *Monochirus hispidus*.

**Location :** Pleurocercus in muscles of teleosts ; adult in *V. marina*.

**Remarks :** Wardle and McLeod (1952) comment that *Molicola horridus* may turn out to be the earlier stages of Linton's *R. uncinatus*. However, until we know more about the life-history of the latter species, it will be desirable to follow the present course, but if proven to be the same, then the specific name *M. horridus* should have priority.

#### FAMILY : LACISTORHYNCHIDAE

Created by Guiart in 1927, the family definition was emended by Dollfus in 1935, and more recently by Yamaguti (1959) to include *Eulacistorhynchus* Subhapradha, 1957.

Genus GRILLOTIA Guiart, 1927

(Syn. *Heterotetrarhynchus* Pintner, 1929 ; *Pintneriella* Yamaguti, 1934)

**Grillotia erinaceus** (van Beneden, 1858)

(Syn. *Rhynchobothrium imparispine* Linton, 1890- *Tetrarhynchys erinaceus* van Beneden, 1858)

**Scombroid hosts :** *Scomber scombrus* Linnaeus

*Sarda sarda* (Bloch)

*Xiphias gladius* Linnaeus

**Localities :** Woods Hole, New England coast, N.W. Atlantic.

**Non-scombroid hosts :** *Dasyatis centrura*, *Mylobatis freminville*, *Raja eglanteria*, *Raja erinacea*, *R. laevis*, *R. ocellata*, *Squalus acanthias*, *Ammodytes americanus*, *Anguilla chrysypa*, *Centropristis striatus*, *Clupea harengus*, *Cynoscion regalis*, *Gadus callarias*, *Hemitripterus americanus*, *Leptocephalus conger*, *Limanda ferruginea*, *Lophius piscatorius*, *Lophopsetta maculata*, *Melanogrammus aeglefinus*, *Menidia menidia notata*, *Merluccius bilinearis*, *Microgadus tomcod*, *Myoxocephalus aeneus*, *M. octodecimspinosus*, *Osmerus mordax*, *Paralichthys dentatus*, *Pollachius virens*, *Pomatomus saltatrix*, *Pomolobus pseudoharengus*, *Poronotus triacanthus*, *P. strigatus*, *Pseudopleuronectes americanus*, *Stenotomus chrysops*, *Tautoglabrus adspersus*, *Tetronarce occidentalis*, *Urophycis chuss*, *U. tenuis*, *Arnoglossus laterna*, *Glyptocephalus cynglossus*, *Hippoglossus hippoglossus*, *Limanda limanda*, *Microstomus kitt*, *Paralichthys oblongus*, *Pleuronectes platessa*, *Scophthalmus aquosus*, *S. maximus*, *S. rhombus*, *Hexanchus* sp., *Theragra* sp., *Dasycottus* sp., *Lotella* sp., *Lota* sp., *Trigla* sp., *Conger* sp., *Glyptocephalus* sp., and *Centrophorus* sp. [Atlantic or Pacific].

**Location :** Adults in spiral valve of elasmobranchs. Cysts and larvae in viscera, stomach wall, peritoneum, serous coat of intestine, and intestinal wall of teleosts. Both adults and larvae are recorded from *Raja erinacea*.

**Remarks :** For detailed work on the genus as well as this species reference is invited to Johnstone (1912). Ruskowski (1932) has studied the life cycle of this species, and considers that as in *Diphyllbothriidae*, *G. erinaceus* has two intermediate hosts, the first a copepod either *Acartia longicornis*, *Pseudocalanus elongatus*, *Paracalanus parvus*, or *Temora longicornis*. *Anguilla vulgaris*, and the salmon are recorded as freshwater hosts of this otherwise marine species. For host records see Sumner *et al.* (1913), Ronald (1959), and for general discussions and identification of related species, Dollfus (1942) and Wardle and McLeod (1952).

Genus LACISTORHYNCHUS Pintner, 1913

**Lacistorhynchus tenuis** (van Beneden, 1858)

(Syn. *L. planiceps* (Leuckart, 1819) ; *Rhynchobothrium gracile* Diesing, 1863 ; *Rhynchobothrium bulbifer* Linton, 1889 ; *Rhynchobothrium benedeni* (Crety, 1890)

**Scombroid hosts :** *Gymnosarda alleterata* [= *Euthynnus alleteratus* (Rafinesque)]

*Sarda sarda* (Bloch)

*Scomber scombrus* Linnaeus

*Scomberomorus maculatus* (Mitchill)

*Locality*: Woods Hole, Massachusetts, New England Coast, N.W. Atlantic.

*Non-scombroid hosts*: *Mustelus canis*, *Alutera schoepfii*, *Ammodytes americanus*, *Anguilla* sp., *Cynoscion regalis*, *Elops saurus*, *Gadus callarias*, *Menidia menidia notata*, *Menticirrhus saxatilis*, *Merluccius bilinearis*, *Microgadus tomcod*, *Myoxocephalus aeneus*, *Paralichthys dentatus*, *Pomatomus saltatrix*, *Poronotus triacanthus*, *Raja erinacea*, *Spheroides maculatus*, *Squalus acanthias*, *Tetronarce occidentalis*, *Urophycis chuss*, *Hippoglossus hippoglossus*, *Monochirus hispidus*, *Platichthys dentatus*, *Pleuronectes platessa*, *Pseudopleuronectes americanus*, *Scophthalmus aquosus*, *S. maximus*, *Solea lascaris*, *Vulpecula marina*, and *Triakas semifasciatus* [Atlantic, Mediterranean and Pacific].

*Location*: Adults common in spiral valve of elasmobranchs (e.g. *Mustelus canis*); Cysts in stomach and muscles of back (e.g. *Scomber scombrus*).

*Remarks*: For details of life cycle of this species see Young (1954).

#### FAMILY : OTOBOTHRIIDAE

Genus OTOBOTHRIMUM Linton, 1890

Two subgenera, *Otobothrium* s.str., and *Pseudotobothrium* Dollfus, 1942, Yamaguti, 1959 are recognised.

##### *Otobothrium* (*Otobothrium*) *crenacolle* Linton, 1890

*Scombroid hosts*: *Pelamys* [= *Sarda sarda* (Bloch)]

*Xiphias gladius* Linnaeus

*Scomberomorus regalis* (Bloch)

*Locality*: Woods Hole, Massachusetts, U.S.A.

*Non-scombroid hosts*: *Sphyrna zygaena*, *Alutera schoepfii*, *Carcharhinus obscurus*, *Cynoscion regalis*, *Fundulus heteroclitus*, *Mustelus canis*, *Paralichthys dentatus*, *P. albigutta*, *Poronotus triacanthus*, *Trichiurus lepturus*, [Woods Hole and N.W. Atlantic].

*Location*: Adults in spiral valves of elasmobranchs (e.g., *Sphyrna zygaena*). Cysts in flesh and viscera of teleosts.

##### *Otobothrium* (*Otobothrium*) *balli* Southwell, 1929

*Scombroid host*: *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality*: Pearl Banks off Ceylon, Gulf of Mannar.

*Non-scombroid hosts*: *Lethrinus ornatus* and *Balistes stellatus* [Pearl Banks off Ceylon, Gulf of Mannar]; *Aprion pristipoma* [Nagapatnam, Tanjore Dt., India, Bay of Bengal].

*Location*: Larvae in teleosts.

##### *Otobothrium* (*Pseudotobothrium*) *dipsacum* Linton, 1897

(Syn. *Otobothrium insigne* Linton, 1905; *Otobothrium insigne* Southwell, 1912)

*Scombroid hosts*: *Xiphias gladius* Linnaeus

*Locality*: Atlantic.

*Non-scombroid hosts*: *Carcharhinus obscurus*, *Pomatomus saltatrix*, *Centropristis striatus*, *Chelidontichthys kumu* [Atlantic and Pacific]; *Serranus undulosus*, *Diagramma crassispinum*, *Balistes mitis*, *Lutjanus dodecacanthus*, and *Lethrinus ornatus* [Pearl Banks off Ceylon, Gulf of Mannar].

*Location*: Adult in elasmobranchs (e.g., *C. obscurus*); Larvae in teleosts.

## FAMILY : PTEROBOTHRIIDAE

Genus PTEROBOTHRIUM Diesing, 1850

(Syn. *Synbothrium* Diesing, 1850 ; *Syndesmobothrium* Diesing, 1854)***Pterobothrium filicolle* (Linton, 1889)**(Syn. *Syndesmobothrium filicolle* Linton ; *Synbothrium filicolle* Linton ; *Gymnorhynchus gigas* Southwell, 1930 in part)

*Scombroid hosts* : 1. *Scomberomorus maculatus* (Mitchill)  
 2. *Scomberomorus regalis* (Bloch)  
 3. *Scomberomorus cavella* (Cuvier)  
 4. *Cybbium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : 1-3. North Western Atlantic ; 4. Pearl Banks, Gulf of Mannar, India.

*Non-scombroid hosts* : *Trygon centura*, *Cynoscion regalis*, *Galeocерdo articus*, *G. tigrinus*, *Lobotes surinamensis*, *Mustelus canis*, *Paralichthys dentatus*, *P. albiguttus*, *Pomatomus saltatrix*, *Pomolobus mediocris*, *Brevoortia tyrannus*, *Mustelus laevis*, *Carcharhinus milberti*, *C. obscurus*, *Lophopsetta maculata*, *Micropogon undulatus*, *Pteroplatea micrura*, *Scoliodon terrae-novae*, *Dasyatis say*, *Seriola dumerili* [Woods Hole, New England Coast ; Beaufort, North Carolina coast, N.W. Atlantic].

*Location* : Scolex in spiral valve of elasmobranchs (e.g., *Dasyatis centrura*). Larvae in teleosts

*Remarks* : Southwell (1930) relegated *Pterobothrium filicolle* (Linton) to the synonymy of *Gymnorhynchus gigas* (Cuvier) along with several other species, giving the following fish hosts : *Dasybatus walga* (adult) ; Larvae from *Cybbium guttatum*, *Chorinemus tolooo*, *C. lysan*, *Chirocentrus dorab*, *Serranus* sp., *Balistes* sp., *Lutjanus* sp., *Pristis cuspidatus*, *Arius gagora*, *Harpodon nehereus*, *Hemigaleus balfouri*, *Trichiurus savala*, and *Clupea ilisha*, all from Indian waters. Of these, Yamaguti (1959) only mentions *C. lysan*, *C. ilisha*, *C. guttatum*, and *H. nehereus* as hosts for *P. filicolle*. The following three species of *Pterobothrium* are also treated by Southwell (1930) as synonyms of *Gymnorhynchus gigas*, but I have followed Yamaguti (1959) in considering them as distinct.

***Pterobothrium heteracanthus* Diesing, 1850**

*Scombroid host* : *Cybbium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Pearl Banks off Ceylon, Gulf of Mannar.

*Non-scombroid hosts* : *Micropogon lineatus* [Brazil] ; *Pristipoma coro*, *Drepane punctata* [Indian seas].

***Pterobothrium platycephalum* (Shipley and Hornell, 1906)**

[Syn. *Tetrarhynchus platycephalus* Shipley and Hornell, 1906 ; *T. rubromaculatus* Diesing, 1863 ; *Tentacularia rubromaculata* (Diesing, 1863) Southwell, 1930]

*Scombroid hosts* : *Cybbium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Pearl Banks off Ceylon, Gulf of Mannar.

*Non-scombroid hosts* : *Chorinemus tolooo*, *Chirocentrus dorab*, *Serranus* sp., *Lutjanus* sp., *Pristis cuspidatus*, *Trachinotus botla* [Gulf of Mannar, off Ceylon Pearl Banks] ; *Arius gagora*

(Delta of Ganges, Bengal, India) ; *Hemigaleus balfouri*, *Trichiurus savala* [East Coast of India] ; *Dasybatus wagla* [Gulf of Mannar, off Pearl Banks of Ceylon].

*Location* : Adults in elasmobranchs (e.g. *D. wagla*) ; Larvae in teleosts.

***Pterobothrium tangoli* (MacCallum, 1921)**  
(Syn. *Rhynchobothrium tangoli* MacCallum, 1921)

*Scombroid host* : 'Scomberiform fish' (The specific name in vernacular is applied for the little tunny *Euthynnus affinis affinis*, or to the northern bluefin tuna *T. (Kishinoella) tonggol* in Indonesia. The host could be any one of these or some other species of tuna).

*Locality* : Borneo.

*Non-scombroid hosts* : None.

*Location* : Encysted in peritoneum.

### SPECIES INCERTE SEDIS

According to Yamaguti (1959), the following are the species whose generic assignment is obviously incorrect or doubtful or those which were referred to heterogenous genera that have no right of standing in modern taxonomy. Of the several listed by him, the following given in their original combination have also scombroid fishes as hosts. Species are given in alphabetical order.

***Rhynchobothrium ambiguum* Diesing, 1863**

*Scombroid host* : *Xiphias gladius* Linnaeus

*Non-scombroid hosts* : *Heptanchus* sp., *Pristiurus* sp., *Raja* sp.

***Tetrarhynchus attenuatus* Rudolphi, 1819**

*Scombroid host* : *Xiphias gladius* Linnaeus

*Non-scombroid hosts* : *Carcharhinus* sp., *Vulpicula* sp., *Squalus fernandinus*, *Thrysites atun*, *Merluccius capensis*.

***Bothriocephalus claviger* Leuckart, 1819**

*Scombroid host* : *Xiphias gladius* Linnaeus

***Rhynchobothrium longispine* Linton, 1890**

*Scombroid hosts* : *Scomber scombrus* Linnaeus

***Scomberomorus maculatus* (Mitchill)**

*Non-scombroid hosts* : Adult in spiral valve of *Trygon cantrura* ; Larvae in *Leptocephalus*, *Menticirrhus saxatilis*, *Paralichthys dentatus*, *Poronotus triacanthus*, *Prionotus strigatus*, *Stenotomus chrysops*, *Urophycis chuss*.

**Tentacularia macfieii** Southwell, 1929

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Non-scombroid hosts* : *Chorinemus lysan*, *C. tolo*, *Lutjanus argentimaculatus*, *L. gibbus*, *Serranus undulosus*, *Balistis mitis*, *B. stellatus*, *Balistis* sp., *Psettodes erumei*, *Cossyphus axillaris*, *Trichiurus savala* [Ceylon Pearl Banks, Gulf of Mannar]

**Tetrarhynchus megabothrius** Rudolphi, 1819

*Scombroid host* : *Scomber sarda* [= *Sarda sarda* (Bloch)]

**Tetrarhynchus pearsoni** Southwell, 1929

*Scombroid host* : *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)] (Pearl Banks off Ceylon, Gulf of Mannar ; Orissa coast, India).

**Tetrabothriorhynchus scombri** Diesing, 1854

*Scombroid host* : *Scomber scomber* (= *Scomber scombrus* Linnaeus)

**? Tetrarhynchus scomber-gobius** Wagener, 1854**Tetrarhynchus scomber-pelamys** Wagener, 1854

*Scombroid host* : *Scomber pelamys* [= *Sarda sarda* (Bloch)]

**Tetrarhynchus scomber-rochei** Wagener, 1854

*Scombroid host* : *Scomber rochei* [= ? *Auxix thazard* (Lacépède)]

**Tetrarhynchus scomber-thynnus** Wagener, 1854

*Scombroid host* : ? *Thunnus thynnus thynnus* (Linnaeus)

**Rhynchobothrium spiracornuatus** Linton, 1907

*Scombroid host* : *Thynnus* sp. (= 'Thynnus sp.') [Gulf of Mannar off Ceylon].

*Non-scombroid hosts* : *Epinephalus maculosus*, *Paranthias furcifer* (N.W. Atlantic) ; *Caranx* sp. [Gulf of Mannar].

*Remarks* : *Thynnus* sp. is from the Gulf of Mannar and this could represent any one of the following species which are fairly common in the Pearl Banks off Ceylon and India in the Gulf of Mannar : *Euthynnus affinis affinis* (Cantor), *T. (Kishinoella) tonggol* (Bleeker), and *T. (Neothunnus) albacares macropterus* (Temminck and Schlegel). For the description of larvae infesting *Caranx* sp., and *Thunnus* sp., reference may be made to Southwell (1930).

**Tetrarhynchus thynni** Wagener, 1854

*Scombroid host* : *Thynnus* sp. (= *Thunnus* sp.)



**Dibothriorhynchus xiphae** MacCallum, 1921

*Scombroid host* : *Xiphius gladius* Linnaeus

*Remarks* : Nigrelli (1938) considers this a synonym of *Dibothriorhynchus attenuatus* (Rudolphi, 1819) (= *Rhynchobothrium attenuatus* Rudolphi, 1819). Wardle and McLeod (1952) consider *Dibothriorhynchus*, a synonym of *Hepatoxylon* Bosc, 1811.

Besides these species listed by Yamaguti (1959) the following should also be mentioned as known from scombroid fishes.

Cestode cysts and larvae from *Scomberomorus regalis* (Bloch). See Linton (1904).

*Rhynchobothrium* sp. Cysts in viscera of *Scomberomorus maculatus* (Mitchill), and *S. regalis* (Bloch), besides a few other teleosts. See Linton (1904).

*Dibothrium* sp. Cysts in intestine of *Scomber scombrus* Linnaeus and other teleosts, adults in elasmobranch. See Linton (1901) and Sumner, *et al.* (1913).

*Tetrarhynchus* sp. (Linton, 1901). Cysts from *Sarda sarda* (Bloch), and *Scomberomorus regalis* (Bloch) in addition to several other teleosts from the Woods Hole area (see Sumner *et al.* 1913).

*Tetrarhynchus* sp. I. Cysts from *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]. (Gulf of Mannar). See Shipley and Hornell, (1906). Larval form of uncertain generic position (Southwell, 1930).

*Tetrarhynchus* sp. II. From *Cybium guttatum* [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)] (Gulf of Mannar). See Shipley and Hornell, (1906). Larval form of uncertain generic position (Southwell, 1930).

It is likely that helminth literature may contain descriptions of a few more such unidentified larval cestodes which are also known from Scombroid fishes.

**HOST-PARASITE LIST No. III**

[List of names of scombroid hosts and their cestode parasites. Genera are arranged alphabetically. (?) indicates doubtful record of parasite species from host ; (\*) species incerte sedis : (\*\*) forms unidentifiable].

<i>Auxis thazard</i> (Lacépède).....	<i>Callitetrarhynchus gracilis</i> (Rudolphi) * <i>Tetrarhynchus scomber-rochei</i> Wagener
<i>Istiophorus gladius</i> (Broussonnet).....	<i>Bothriocephalus manubriiformis</i> (Linton)
<i>Katsuwonus pelamis</i> (Linnaeus).....	<i>Tentacularia bicolor</i> (Bartels)
<i>Sarda sarda</i> (Bloch).....	<i>Grillotia erinaceus</i> (van Beneden) <i>Lacistorhynchus tenuis</i> (van Beneden) <i>Scolex peluronectis</i> Mueller <i>Tentacularia bicolor</i> (Bartels) <i>Tentacularia coryphaena</i> Bosc * <i>Tetrarhynchus megabothrium</i> Rudolphi * ? <i>Tetrarhynchus scomber-pelamys</i> Wagener ** <i>Tetrarhynchus</i> sp. (Linton, 1901)

<i>Scomber scombrus</i> Linnaeus.....	<i>Bothriocephalus scorpii</i> (Mueller) <i>Callitetrarhynchus gracilis</i> (Rudolphi) <i>Grillotia erinaceus</i> (van Beneden) <i>Lacistorhynchus tenuis</i> (van Beneden) <i>Nybelinia</i> ( <i>Nybelinia</i> ) <i>bisulcata</i> (Linton) <i>Scolex pleuronectis</i> Mueller * <i>Rhynchobothrium longispine</i> Linton * <i>Tetrarhynchus scombrus</i> Diesing ** <i>Dibothrium</i> sp. (Linton, 1901)
<i>Scomber</i> sp.....	<i>Tentacularia coryphaena</i> Bosc
<i>Scomberomorus cavalla</i> (Cuvier).....	<i>Pterobothrium filicollis</i> (Linton)
<i>Scomberomorus guttatus guttatus</i> (Bloch and Schneider).....	<i>Otobothrium</i> ( <i>Otobothrium</i> ) <i>balli</i> Southwell <i>Pterobothrium filicollis</i> (Linton) <i>Pterobothrium heteracanthus</i> Diesing <i>Pterobothrium platycephalum</i> (Shiple and Hornell) * <i>Tentacularia macfieii</i> Southwell * <i>Tetrarhynchus pearsoni</i> Southwell ** <i>Tetrarhynchus</i> sp. I. (Shiple and Hornell, 1906) ** <i>Tetrarhynchus</i> sp. II. (Shiple and Hornell, 1906)
<i>Scomberomorus maculatus</i> (Mitchill).....	<i>Callitetrarhynchus gracilis</i> (Rudolphi) <i>Lacistorhynchus tenuis</i> (van Beneden) <i>Pterobothrium filicollis</i> (Linton) * <i>Rhynchobothrium longispine</i> Linton ** <i>Rhynchobothrium</i> sp. (Linton, 1904)
<i>Scomberomorus regalis</i> (Bloch).....	<i>Octobothrium</i> ( <i>Octobothrium</i> ) <i>crenaticollis</i> Linton <i>Pterobothrium filicollis</i> (Linton) ** <i>Rhynchobothrium</i> sp. (Linton, 1904) ** <i>Tetrarhynchus</i> sp. (Linton, 1901) ** Cestode cysts (Linton, 1904)
Scombriform fish ' [? <i>Euthynnus</i> spp. or <i>Kishinoella tonggol</i> ?].....	<i>Pterobothrium tangoli</i> (MacCallum)
<i>Tetrapturus albidus</i> Poey.....	<i>Bothriocephalus manubriiformis</i> (Linton)
<i>Thunnus</i> ( <i>Thunnus</i> ) <i>thynnus orientalis</i> (Temminck and Schlegel).....	<i>Pelichnibothrium speciosum</i> Monticelli
<i>Thunnus</i> ( <i>Thunnus</i> ) <i>thynnus thynnus</i> (Linnaeus)	* ? <i>Tetrarhynchus scomber-thynnus</i> Wagener
<i>Thunnus</i> sp.....	<i>Callitetrarhynchus gracilis</i> (Rudolphi) <i>Tentacularia coryphaena</i> Bosc * <i>Rhynchobothrium spirocornuatus</i> Linton * <i>Tetrarhynchus thynni</i> Wagener

<i>Xiphias gladius</i> Linnaeus.....	<i>Fistulicola plicatus</i> (Rudolphi)
	<i>Grillotia erinaceus</i> (van Beneden)
	<i>Gymnorhynchus</i> ( <i>Gymnorhynchus</i> ) <i>gigas</i> Cuvier
	<i>Gymnorhynchus</i> ( <i>Molicola</i> ) <i>uncinatus</i> (Linton)
	<i>Nybelinia</i> ( <i>Nybelinia</i> ) <i>bisulcata</i> (Linton)
	<i>Nybelinia</i> ( <i>Nybelinia</i> ) <i>lamontae</i> Nigrelli
	<i>Nybelinia</i> ( <i>Nybelinia</i> ) <i>lingualis</i> (Cuvier)
	<i>Otobothrium</i> ( <i>Otobothrium</i> ) <i>crenacolle</i> Linton
	<i>Otobothrium</i> ( <i>Otobothrium</i> ) <i>dispacum</i> Linton
	<i>Phyllobothrium loliginis</i> (Leidy) Linton
	<i>Scolex pleuronectis</i> Mueller
	<i>Tentacularia bicolor</i> (Bartels)
	<i>Tentacularia coryphaena</i> Bosc
	* <i>Bothriocephalus claviger</i> Leuckart
	* <i>Dibothriorhynchus xiphiae</i> MacCallum
	* <i>Rhynchobothrium ambiguum</i> Diesing
	* <i>Tetrarhynchus attenuatus</i> Rudolphi

### PRELIMINARY ANALYSIS OF SCOMBROID HOSTS AND THEIR TREMATODE AND CESTODE PARASITES, WITH SPECIAL REFERENCE TO INDIAN SEAS

As already mentioned, it is too early to speculate on the zoogeography of scombroid fishes and their parasites. This paper lists, (excluding the numerous synonymies) 206 species and forms of Monogenea, Digenea, and Cestoda. A preliminary analysis of this data, especially with reference to scombroid fishes from Indian seas, which is no doubt also true of several other geographical areas, shows that :

1. The scombroid parasite data are very incomplete for this area and there is considerable scope for more intensive investigations.
2. Several scombroid species have not been examined for their parasites from this area, while many parasite species have been described from these hosts from extra-Indian waters.

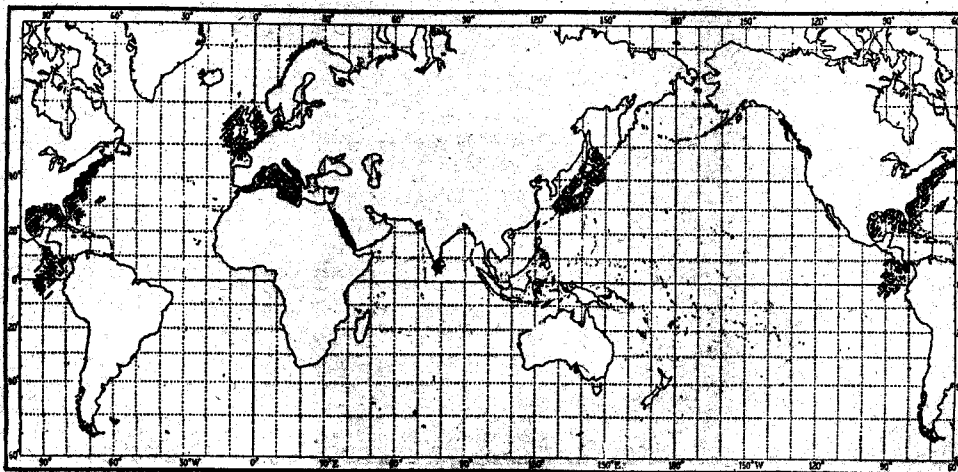


Fig. 1. Map showing areas hatched from where the great majority of trematode and cestode parasites of scombroid fishes have been described.

Tables I and II are given to emphasise the need for more intensive work on Scombroid fishes and their parasites on a world wide basis. At present the areas where a reasonable amount of work has been carried out are (1) the east coast of U.S.A., including the Gulf of Mexico (N.W. Atlantic); (2) British waters, French coast (N.E. Atlantic), and Western Mediterranean; (3) Red Sea; (4) Gulf of Mannar between India and Ceylon (For mostly Cestodes); (5) Japanese Sea; and (6) Galapagos Islands and adjacent Pacific. The intervening areas, from where only stray works are available on scombroid fish parasites, (Fig. 1) will give some idea of the considerable gaps yet to be filled in.

TABLE I

*Total number of helminth parasites listed in this work along with the numbers occurring in Indian seas<sup>1</sup>*

Parasite group		Total Number	In Indian Seas
Monogenea	Species.....	76	22
	Species unidentifiable.....	2	2
Digenea	Species.....	100	5
	Species unidentifiable.....	..	..
Cestoda	Species.....	27	7*
	Species unidentifiable.....	21+	4
Total		226	40

<sup>1</sup> Additions given in Addendums I, II and III are also included in Tables I and II.

\* Few of the Indian records are from non-scombroid fishes as well.

TABLE II

*Species and subspecies of scombroid fishes listed parasite group-wise*

Parasite group						Species and subspecies of Scombroid fishes (Host records only)		
						Total No.	Occurring in Indian seas	No. examined for parasites from Indian seas
<b>Monogenea</b>								
A. Valid scombroid sp. & sub. spp. and hosts .. ..						32	19*	8*
B. Host identifiable only up to genus.. ..						5	2	2
<b>Digenea</b>								
A. .. ..						25	15	4
B. .. ..						2	..	..
<b>Cestoda</b>								
A. .. ..						13	6	2
B. .. ..						3	..	..

\* *Scomberomorus commerson* (Lacépède), and *S. lineolatus* (Cuvier and Valenciennes), probable hosts of *Plicae multae* Chauhan are also included.

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## APPENDIX I

(List of Ichthyological references that may be consulted)

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For easy reference, these are annotated below, both group-wise as well as region-wise. The numbers refer to those given in the above list.

#### Group-wise.

General : 1, 2, 3, 7, 8, 14, 19, 22.  
 Mackerels : 1, 3, 7, 8, 10, 17.  
 Seerfishes or Spanish mackerels : 1, 3, 4, 6, 7, 8, 13, 17.  
 Tunas : 1, 3, 4, 5, 7, 8, 17, 18, 21, 24.  
 Billfishes : 1, 7, 9, 11, 12, 15, 16, 20, 23.

#### Region-wise.

Indo-Pacific : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23.  
 Atlantic (Including Mediterranean) : 3, 9, 16, 17, 18, 19, 24.

## ADDENDUM—I

Since this paper was sent to the press, the following works dealing with trematode parasites, some of which infest scombroid fishes, have come to my notice. In order to make this account up-to-date and useful, these additional references are listed below and the parasites and their hosts are indicated as given in the main paper.

### ADDITIONAL REFERENCES

- HIDALGO ESCALANTE, E. 1959. Hallazgo de una nueva especie de *Capsala*, *Capsala pricei* n. sp. (Trematoda, Monogenea) en un pez Marino del Puerto de Mazatlan, Sinaloa, Mexico. *Anales del Inst. de Biol. Mexico* 29 (1&2) : 209-217.
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- . 1961b. On a new species of the genus *Lithidocotyle* (Monogenea : Gastrocotylidae), its juveniles and immature forms from the gills of *Scomberomorus guttatus*. *Ibid.*, B, 31(2) : 175-181.
- TRIPATHI, Y. R. 1957. Monogenetic trematodes of fishes from India. *Indian J. Helminthology*, 9(1 & 2) : 1-149.
- UNNITHAN, R. V. 1957. On the functional morphology of a new fauna of Monogenea on fishes from Trivandrum and environs. Part I. Axinidae Fam. Nov. *Bull. Central Res. Inst. Univ. Kerala*, 5(2) : 27-122.

### MONOGENETIC TREMATODES

#### FAMILY : CAPSALIDAE

##### *Capsala pricei* Hidalgo Escalante, 1959

- Scombroid host* : 1. *Makaira mitzukurii* (Jordan and Snyder) (= *Tetrapturus audax* Philippi)  
2. *Makaira marlina* [= *Makaira indica* (Cuvier)].
- Locality* : 1. Mazatlan, Sinaloa, Pacific coast of Mexico. 2. Panama (Pacific).
- Non-scombroid hosts* : None.
- Location* : Ventral side of body.
- Remarks* : Price (1960) redescribed and figured this species.

#### FAMILY : MICROCOTYLIDAE

Unnithan (1957) created the family Axinidae and placed it with Microcotylidae and Gastrocotylidae in the superfamily Microcotyloidea. A new genus *Uraxine* was described by him under the family Axinidae. In view of the doubtful validity of some of the higher categories, I have adopted here the emendations of Hargis (1956) placing subfamily Axininae under the family Microcotylidae.

##### Genus *Uraxine* Unnithan, 1957

##### *Uraxine chura chura* Unnithan, 1957

- Scombroid host* : *Euthynnus affinis* (Cantor) [= *Euthynnus a. affinis* (Cantor)]
- Locality* : Trivandrum, S.W. coast of India.
- Non-scombroid hosts* : None.
- Location* : Gills.

**Uraxine chura macrova** Unnithan, 1957

*Scombroid host* : *Euthynnus affinis* (Cantor) [= *Euthynnus a. affinis* (Cantor)]

*Locality* : Trivandrum, S.W. coast of India.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : Unnithan (1957) described from the same host a second subspecies, *Uraxine chura macrova* and as such the forma typica should have been designated by him as *Uraxine chura chura*. The subspecies *U.c.macrova* is said to differ from the forma typica, *U.c.chura* in being relatively smaller in size, but having larger eggs; the shape of the body; the size of the haptorial units in relation to the length of the body; the anchors of the lappet; the disposition of the testes in the par ovarian rows and in the shape and extent of the vitelline duct. In spite of these differences Unnithan (1957) opines that '... the close similarity of *Uraxine chura macrova* to *Uraxine chura* suggests a more reasonable subspecific rank for *Uraxine chura macrova*.' Ramalingam's recent works (1961a, 1961b) on species of *Lithidocotyle* are very suggestive drawing attention to the extent to which some of the abovementioned characters, such as body shape, number and disposition of haptorial units, etc. could be variable in the same species collected from different parts of the gill arch of a host specimen.

## FAMILY : MAZOCRAEIDAE HARMANN, 1782

Genus *Kuhnina* Sproston***Kuhnina indica*** Tripathi, 1957 (Pp. 86-89, figs. 41a-d)

*Scombroid host* : *Cybium guttatum* Bloch and Schneider [= *Scomberomorus guttatus guttatus* (Bloch and Schneider)]

*Locality* : Puri, Orissa Coast, Bay of Bengal.

*Non-scombroid host* : None.

*Location* : ? (Gills and buccal cavity?).

Genus *Indomazocares* Tripathi, 1957***Indomazocares jagannath*** Tripathi, 1957

*Scombroid host* : *Rastrelliger kanagurta* (Cuvier) [= *Rastrelliger kanagurta* (Cuvier)]

*Locality* : Puri, Orissa Coast, Bay of Bengal.

*Non-scombroid hosts* : None.

*Location* : ? (Gills and buccal cavity?).

*Remarks* : This genus is considered a synonym of *Pseudoacanthocotyle* Bychowsky and Nagibina (1954) by Price, 1961 (see reference under Addendum-III).

Genus *Lithidocotyle* Sproston, 1946. emend. Hargis, 1956***Lithidocotyle secunda*** Tripathi, 1954

*Scombroid host* : *Scomberomorus guttatus* [= *Scomberomorus g. guttatus* (Bloch and Schneider)]

*Locality* : Madras Coast.

*Non-scombroid hosts* : None.

*Location* : Gills.

*Remarks* : The species is redescribed by Ramalingam (1961a).



**Lithidocotyle bivaginalis** Ramalingam, 1961b

**Scombroid host:** *Scomberomorus guttatus* [= *Scomberomorus g. guttatus* (Bloch and Schneider)]

**Locality:** Madras Coast.

**Non-scombroid hosts:** None.

**Location:** Gills.

**HOST-PARASITE LIST NO. I—(Contd.)**

SCOMBROID HOST	PARASITE (Monogenea)
<i>Euthynnus affinis affinis</i> (Cantor).....	<i>Uraxine chura chura</i> Unnithan <i>Uraxine chura macrova</i> Unnithan
<i>Makaira indica</i> (Cuvier).....	<i>Capsala pricei</i> Hidalgo Escalante
<i>Rastrelliger kanagurta</i> (Cuvier).....	<i>Indomazocares jagannath</i> Tripathi
<i>Scomberomorus guttatus guttatus</i> (Bloch and Schneider)	<i>Kuhnia indica</i> Tripathi <i>Lithidocotyle bivaginalis</i> Ramalingam <i>Lithidocotyle secunda</i> Tripathi. (This species has already been mentioned in the host-parasite list on p. 818)
<i>Tetrapturus audax</i> Philippsi.....	<i>Capsala pricei</i> Hidalgo Escalante

**REMARKS**

Since the above additions refer to monogenetic trematodes, I wish to offer a few comments. As already mentioned, species of this group appear to evince host specificity to a greater degree than digenetic trematodes or cestodes. A glance at the host-parasite list no. 1 would show that up to now the greatest number of species (eleven plus two doubtful = 13) has been reported from the spotted spanish mackerel *Scomberomorus guttatus guttatus* (Bloch and Schneider), from India and the absence of any definite records of monogenetic trematodes from the two other spanish mackerels from this area, namely *S. commerson* (Lacépède) and *S. lineolatus* (Cuvier and Valenciennes) is glaringly conspicuous. Either these species have not been investigated for monogenetic trematode parasites or there is the possibility of faulty host identification. The latter possibility cannot be completely overlooked as it is not uncommon for juveniles and adults of these three species of *Scomberomorus* to be landed with the same gear at the same time, and to the untrained, the identification, especially of the juveniles may be difficult.

**ADDENDUM—II**

Between 1962 and 1965, a few more papers have appeared wherein references to helminth parasites of scombroid fishes are made. Most of the papers listed below appeared in the Proceedings of the 'World Scientific Meeting on the Biology of Tunas and Related Species' published as FAO Fishery Report No. 6, Volumes 1-3 (1963). The helminth species (Trematodes and Cestodes) mentioned are listed under each reference with additional remarks wherever necessary. A separate 'Host-Parasite' list is not given here as most of the species have already been dealt with in the main part of this paper and there are very few new host records.

BELL, R. R. 1963. Synopsis of biological data on California Bluefin tuna *Thunnus salinus* Jordan and Evermann 1926. FAO Fishery Biology Synopsis No. 55. FAO Fishery Rept., No. 6, 2: 380-421.

*Didymocystis guernei* (Several fusiform adults in cysts up to 15 mm long under serosa of the stomach; and reproductive bodies from minute to 4 mm in diameter on the gill filament, arches and rakers); *Hirudinella fusca* (from stomach); and monogenetic trematode *Tricotyla thynni* (from gills).

- DEMIR, M. 1963. Synopsis of Biological data on Bonito *Sarda sarda* (Bloch) 1793. *Ibid.*, No. 6, 2 : 101-129.  
Trematode *Didymozoon pelamyzis* Taschenberg, and cestode *Callitetrarhynchus gracilis* (Rud.) as parasites of *S. sarda*.
- IVERSEN, E. S., and E. E. HOWEN 1958. Some trematodes of fishes from Central Equatorial Pacific. *Pacific Sci.*, 12 (2) : 131-134.  
Trematodes *Capsala biparasitica* (Goto) and *Hirudinella marina* Garcin from the yellowfin.  
——— and H. O. YOSHIDA 1957. Notes on the biology of wahoo in the Line Islands. *Ibid.*, 11 : 370-379.  
Trematode *Hirudinella ventricosa* (Pallas) from stomach of *Acanthocybium solandri*. Also details on rate of infestation.
- KING, J. E., and IKEHARA 1956. Comparative study of food of bigeye and yellowfin tuna in the Central Pacific. *Fish. Bull. U. S. Fish Wild. Serv.*, 57 (108) : 61-85.  
Trematode *Hirudinella sibi* Garcin, from stomach of *Parathunnus sibi* [= *Thunnus* (*Parathunnus*) *obesus mebachii*]; also details on rate of infestation.
- KISHINOUE, K. 1923. Contribution to the comparative study of the so-called scombroid fishes. *J. Coll. Agri. Imp. Univ. Tokyo*, 8 (3) : 293-476.  
Trematode *Distomum* sp., from *Acanthocybium solandri*; and cestode *Rhyncobothrium* from *Katsuwonus pelamis*.
- MCMAHON, J. W. 1964. Monogenetic trematodes from some Chesapeake Bay fishes. Part II. The superfamily Diclidophoroidea. *Chesapeake Science*, 5 (3) : 124-133.  
Records the following four species from the gills of *Scomberomorus maculatus* (Mitchill) : *Scomberocotyle scomberomori* (Koratha, 1955) Hargis 1956; *Pseudaxine mexicana* Meserve, 1938; *Lithidocotyle acanthophallus* (MacCallum and McCallum, 1913); and *Thoracocotyle crocea* MacCallum, 1913.
- POSTEL, E. 1963. Expose synoptique sur la biologie du Germon Germon alalunga (Cetti) 1777 (Atlantique Oriental) FAO Fishery Biology Synopsis No. 77. *FAO Fishery Rept.* No. 6, 2 : 931-975.  
Lists the undermentioned trematodes and cestodes: Trematoda—*Didymocystis guernei* (from branchiae, muscles and other parts of body); *Platocystis alalongae* (from pectoral and posterior dorsal region); *Nematobothrium guernei* (from musculature periesophaginne); *Hirudinella fusca*, *H. poirieri*, and *H. ventricosa* (from stomach); and the monogenetic trematode *Tricotyle thynni* from the gills. Cestoda—*Heptoxylon trichiuri* = *H. squali* (postlarvae) (from stomach, rectum and liver); *Sphyricephalus tergestinus* (postlarvae) (from pyloric caecae); and *Pseudobothrium grimauidi* (from pyloric caecae and duodenum).
- PRICE, E. W. 1938. The monogenetic trematodes of Latin America. *Livro Jubilar do Professor Lauro Travassos*, Rio de Janeiro, Brazil, 407-414.  
——— 1939. North American Monogenetic Trematodes. III. The family Capsalidae (Capsaloidea). *J. Wash. Acad. Sci.* 29 (2) : 63-92.
- RAJU, G. 1963. New records of the giant trematodes of the genus *Hirudinella* Garcin from Indian waters. *J. Mar. biol. Ass. India*, 4 (1 & 2) : 232-234.  
Records *Hirudinella marina* Garcin from stomach of *Katsuwonus pelamis* and *Neothunnus macropterus* (= *T. (N.) albacares macropterus*) (from Minicoy Island, Laccadive Sea) and from *Euthynnus a. affinis* (from Tuticorin, Gulf of Mannar); and *Hirudinella ventricosa* Pallas from the stomach of *Acanthocybium solandri* (from Minicoy Island, Laccadive Sea and Tuticorin, Gulf of Mannar). Details of rate of infestation are also given.
- ROBINSONS, J. P. 1963. Synopsis of Biological data on bluefin tuna *Thunnus thynnus maccoyi* (Castelnau) 1872. FAO Fishery Biology Synopsis No. 60. *FAO Fishery Rept.* No. 6, 2 : 562-587.  
Trematode *Hirudinella* sp. in gut; infection light, intensity ranging from 0 to 2 per individual.
- TIEWS, K. 1963. Synopsis of Biological data on bluefin tuna *Thunnus thynnus* (Linnaeus) 1758 (Atlantic and Mediterranean). FAO Fishery Biology Synopsis No. 56, *ibid.*, No. 6, 2 : 422-482.  
Lists the Monogenetic trematodes *Hexacotyle thynni* (Delaroche, 1811) v. Nordmann, 1840 (from gill lamellae of first gill arch); and *Tristoma onchidiocotyle* Setti 1899 (from copulae connecting gill arches of both body sides) Digenetic trematodes listed are: *Didymocystis wedli* Ariola, 1902 found encysted in small capsules of each two individuals on gill lamellae; and *Hirudinella clavata* Menzies, 1791 (from intestine).

UNNITHAN, R. V. 1964. On five new species of Monogenetic trematodes parasitic on the gills of marine fishes from the south west coast of India. *Treubia*, 26 (3): 159-178.

Describes one new genus and species—*Scomberocola eyela*—from the gills of the Indian mackerel *Rastrelliger kanagurta* (Cuvier).

WALDRON, K.D. 1963. Synopsis of biological data on skipjack *Katsuwonus pelamis* Linnaeus 1758 Pacific Ocean FAO Fishery Biology Synopsis No. 65, *Ibid.*, No. 6, 2: 695-748.

The detailed list contains the undermentioned species of trematode and cestode parasites not given as infesting this species in 'Host-Parasite Lists' Nos. 2 and 3 in this paper. Trematodes—*Didymozoon auxis* Taschenberg; *Tergestia laticollis*; *Hirudinella clavata*; *Hirudinella ventricosa* and *Tristomum laeve*. All these have been recorded from other scombroid hosts as will be seen from 'Host-Parasite List No. 2. The cestodes recorded are: *Tentacularia coryphaenae* (Bosc, 1802); *Calloitetraerhynchus speciosus* (Linton, 1897); *Pelichnibothrium* (larva) (Yamaguti, 1934); and *Rhyncobothrium* (Kishinouye, 1923).

WILLIAMS, F. 1964. The Scombroid Fishes of East Africa. *Symposium on Scombroid Fishes*, Part I: 107-164.

Records: Trematode *Hirudinella marina* Garcin and cestode *Bothriocephalus manubriiformis* (Linton) from the yellowfin; and *Hirudinella ventricosa* from the stomach of *Acanthocybium solandri*. Details of rates of infestation of *H. ventricosa* are also given.

YOSHIDA, H.O., and OTEU, T. 1963. Synopsis of Biological data on albacore *Thunnus germon* (Lacépède) 1800 (Pacific and Indian Ocean) FAO Fishery Biology Synopsis No. 52. *FAO Fishery Rept.* No. 6, 2: 274-318.

Lists trematodes *Hirudinella spinulosa* (from stomach); *Didymocystis alalongae* from gill arch; and *Platocystis alalongae* (on skin); and the cestode *Metanematobothrium guernei* (in sub-maxillary muscles).

To sum up, the additional helminth parasites with scombroid host records not mentioned earlier in this paper are:

#### Monogenetic Trematoda:

1. *Scomberocola eyela* from *Rastrelliger kanagurta* from S. W. Coast of India.

#### Digenetic Trematoda:

1. *Hirudinella sibi* from *Parathunnus sibi* (= *Thunnus* (*Parathunnus*) *obesus mebachii*) from Central Pacific.

#### Cestoda:

1. *Heptoxylon trichiuri* = *H. squali* (postlarvae);
2. *Sphyricephalus tergestinus* (postlarvae); and
3. *Pseudobothrium grimaldii* from *Germo alalunga* [= *Thunnus* (*T.*) *alalunga*] from Eastern Atlantic.
4. *Melanematobothrium guernei* from *Thunnus germon* [*Thunnus* (*T.*) *alalunga*] from the Pacific.

## ADDENDUM—III

Five recent works pertaining to Monogenea are given here. Of these, Price (1960a) has been already mentioned under Addendum-I. However, the works of Price (1960a, 1960b, 1961) and Yamaguti (1963) contain some emendations in the classification of some of the divisions of Monogenea in addition to descriptions of new taxonomic higher categories. Those concerning species which infest scombroid fishes are briefly dealt with below. Five new species of monogenetic trematodes (three nom. nov., and two new species) are described in these works.

BYCHOWSKY, B. E. and L. F. NAGIBINA 1954. (New monogenetic trematodes from the Pacific Ocean) (In Russian). *Zool. Zhurnal.*, 33 (1) : 30-38.

Describes a new genus and species—*Pseudoacanthocotyle pavlovskiy* from the scombroid host *Scomber canagurta* (= *Rastrelligur kanagurta* (Cuvier)) from Ryukyu Islands, Pacific.

PRICE, E. W. 1960a. The giant marlin, *Makaira marlina* Jordan and Evermann, a new host for *Capsala pricei* Hidalgo, 1959, with a review of the subfamily Capsalinae. *Libr. Hom. al. Dr. Caballero*, pp. 237-244.

Besides the new scombroid host record for *Capsala pricei*, a new genus *Caballerocotyla* with *Capsala biparasitica* (Goto) as genotype is described. Seven other species listed in the present work under the genus *Capsala*, namely *C. caballerio* Winter (1954), *C. gouri* Chauhan (1952), *C. katsuoni* (Ishii, 1936), *C. magronum* (Ishii, 1936), *C. manteri* Price (1952), *C. megacotyle* (von Listow, 1906), and *C. pelamydis* (Taschenberg, 1878) are relegated to *Caballerocotyla*. At the same time, *C. leavis* (Verrill 1874), *C. interrupta* (Monticelli, 1891), *C. lintoni* Price (1939), *C. nozawae* (Gotto, 1894), *C. onchidocotyle* (Setti, 1899), *C. ovalis* (Goto, 1894), *C. poeyi* (Vigueras, 1935) and *C. pricei* Hidalgo Escalante (1959) are included under the genus *Tristomella* Guiart (1938).

PRICE, E. W. 1960b. North American Monogenetic Trematodes. VIII. The Family Hexostomatidae. *Proc. Helm. Soc. Washington*, 28 (1) : 4-9.

Considers *Hexostoma macracanthum* Fujii (1944) a synonym of *Neohexostoma euthynni* (Meserve, 1938). Describes a new genus *Neohexostoma* with *Octocotyle thunninae* Parona and Perugia, 1889 (= *Hexostoma thunninae* as given *vide supra* p. 816) as the genotype. In addition, *Hexostomas extensicaudatum* (Dawes, 1940), and *H. pricei* Koratha (1955) are also placed under this genus. The following are the new species :

- (i) *Neohexostoma robustum* Price, 1960 : On *Parathynnus sibi* (= *Thunnus* (*Parathynnus*) *obesus mebachii* (Kishinouye)) from tropical Pacific.
- (ii) *Hexostoma lintoni* Price, 1960 : nom. nov. for *Hexocotyle thynni* Linton, 1901 (nec *Polystoma thynni* Delaroche) given as a doubtful synonym under *Hexostoma thynni*, *vide supra*, p. 817.

PRICE, E. W. 1961. North American Monogenetic Trematodes. IX. The Families Mazoceracidae and Plectanocotylidae. *Proc. Biol. Soc. Washington*, 74 : 127-156.

Two new names have been proposed as follows :

- (i) *Kunhia sprostonae* Price, 1961 : (nom. nov.) For *Kunhia minor* Sproston (1946) (nec. Goto, 1894) on mackerel found at Plymouth.
- (ii) *Grubea pneumatophori* Price, 1961 : (nom. nov.) For *Pleurocotyle scombr* Linton, 1940 found on *Pneumatophorus grex* (Mitchell) from Woods Hole, Massachusetts, U.S.A.

YAMAGUTI, S. 1963. Monogenea and Aspidocotylea in *Systema Helminthum*, 4 : vii+699 pp. (with 134 plates).

- (i) Regarding *Kunhia thynni* (Ishii and Sawada, 1938) Sproston, 1946, Yamaguti remarks : 'syn. *Dactylocotyle minor* Ishii, 1936, nec *Dactylocotyle minor* (Olsson, 1868) St. Remy, 1898, *Dactylocotyla thynni* Ishii 1936, in Ishii and Sawada, 1938, on *Thunnus orientalis*; Japan. Price (1943, foot note) stated: "*Dactylocotyla minor* Ishii, 1936, renamed *D. tuunni* Ishii in Ishii and Sawada, 1938, does not belong to the genus *Dactylocotyle* (= *Didclidophora*) but is a species of *Mazocercas*," but he is now of the opinion (personal communication) that it is a species of *Kunhia*.'
- (ii) *Uraxine* Unnithan, 1957 is considered a synonym of *Allopseudaxine* Yamaguti, 1943, the type species being *Pseudaxine katsuonis* Ishii, 1936. Yamaguti (1963) considers *Uraxine chura* Unnithan (1957) a synonym of this species. *Uraxine chura macrova* Unnithan (1957) is given a specific rank as *Allopseudaxine macrova* (Unnithan).
- (iii) *Lithidocotyle* Sproston, 1946 is considered a synonym of *Gotocotyla* Ishii, 1936. Consequently, the two species *L. acanthophallus* (MacCallum and MacCallum, 1913), and *L. secundus* Tripathi, 1954 given on p. 810 in this account are placed under the genus *Gotocotyla*.
- (iv) A new genus *Pseudothoracocotyla* is proposed for *Thoracocotyle ovalis* Tripathi, 1956.

In addition to the above five references, I would like to also mention the following reference:

HARGIS, W. J. (Jr.) 1959. Systematic notes on the monogenetic Trematodes. *Proc. Helminth. Soc. Washington*, 26 (1) : 14-31.

As regards the six species of *Pricea* described by Ramalingam (1952) from '*Cyblum guttatum*' Hargis opines that 'In all probability he merely described normal infraspecific variability and most of his species are not valid.'